THE EFFECTS OF PRE-FITTING AND POST-FITTING HEARING AID ORIENTATION ON PATIENT OUTCOME

By

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This investigation compared two presentation types of Hearing Aid Orientation (HAO) with a control group receiving no HAO. The subjects were assigned to one of three groups. Subjects then attended two one-hour pre-fitting HAO's, two one-hour post-fitting HAO's, or no HAO at all, depending on the group to which they were assigned.

Traditional protocol for the elderly client with hearing impairment has been one of voluntary post-fitting HAO. The results of this study demonstrate the advantages of both pre- and post-fitting HAO sessions. Not only has this study demonstrated that pre-fitting counseling is helpful in expediting hearing aid benefit and satisfaction through the education of our clients, but it also suggests that a combination of pre- and post-fitting counseling may be the best clinical procedure to ensure hearing aid acceptance. Based on the results of this study a HAO protocol is proposed.

CHAPTER 1
INTRODUCTION

Audiologic rehabilitation for adults with hearing loss was the catalyst for the formation of the field of audiology in the 1940's (Cherry & Giolas, 1997). It was in 1947 that Carhardt first described an auditory rehabilitation program for adults. As the field of audiology progressed, there was a shift toward diagnostics and away from rehabilitation (Hull, 1992). Currently, there is a resurgence of interest in audiologic rehabilitation. One important reason for this renewed interest is the inability of current technology to provide acceptable relief from all aspects of hearing disablement. Hearing health care providers have neglected to approach patient care as a facilitation of behavioral change in their clients. Realization and desire to make these target behavioral changes (i.e., hearing aid use and communication strategies) by the client is equally important. These behavioral changes may be encouraged through the implementation of an effective audiologic rehabilitation program. Audiologic

Rehabilitation usually manifests itself in the form of a hearing aid orientation (HAO) after the patient has already received the hearing aids. HAO is typically offered on a volunteer basis if at all. Therefore the actual numbers of HAO attendees are typically a very low percentage of the individuals who receive hearing aids in a given clinic.

The concept of audiologic rehabilitation is an essential element to the profession of audiology. Behavioral models such as the Disablement Process as proposed by Verbrugge and Jette (1994), and the Transtheoretical Model of Health Related Behavioral Change developed by Prochaska (1991), may be relevant to audiologic rehabilitation.

The Disablement Process is a socio-medical model of disability (see Figure 1). The term "disablement" refers to impacts that chronic and acute conditions have on the functioning of specific body systems and on people's abilities to act in necessary and personally desired ways in their society (Verbrugge & Jette, 1994). The term "disablement" is a more general term than "disability", covering all consequences of pathology for functioning. Disability is a condition and disablement is the state of a person with that condition (Badley, 1993). The term "process" reflects interest in the dynamics of disablement.

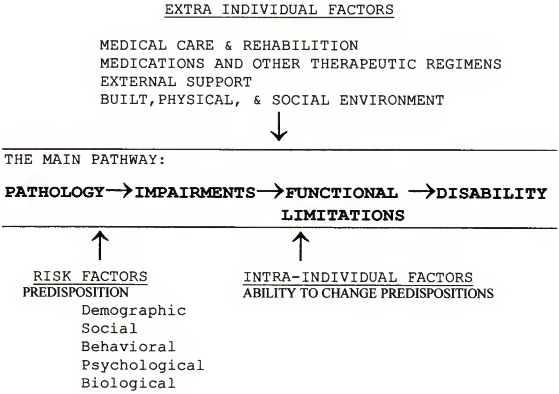

Figure 1. A model of The Disablement Process (Verbrugge and Jette, 1994).

The main pathway of the Disablement Process contains four categories. These categories flow in order from Pathology to Impairments to Functional Limitations, and finally to Disability. Pathology is used to describe biochemical and physiological abnormalities that cross the defined thresholds of clinical significance. In other words pathology involves a diagnosis. Impairments are significant mental and/or physical dysfunction that has consequences for social functioning. Functional limitations are restrictions as a result of pathology in performing fundamental physical and mental actions used in daily life. Disability is difficulty experienced in performing routine activities of daily living due to a health or physical problem. These definitions by Verbrugge and Jette are based on those of the World Health Organization and work by Nagi (1991). The Disablement Process is a socio-medical model in that it addresses both social and medical aspects of disability. Risk factors and interventions are incorporated into the model. Most importantly it goes beyond previous pathway models of disability by having a more dynamic person-environment focus rather than the historical static person focus. This person-environment perspective is an important consideration when designing intervention programs.

Most of our traditional intervention programs have assumed that prospective patients are ready to take action on their unhealthy behavior (Prochaska, 1991). Prochaska states that the available evidence shows this to be the case for a very small proportion of patients. The high rate of hearing aid rejection may support this contention. Prochaska points out that the traditional approach of the concept of individual behavioral change conceptualizes the process as a shift from one stable state to another. Namely, as a shift from chronic unhealthy behavior to chronic healthier behavior.

An alternative approach to this concept of behavioral change would be to regard change as a movement through a series of different stages (Prochaska, 1991). The five stages of the Transtheoretical Model are precontemplation, contemplation, preparation, action, and maintenance. Individuals in precontemplation are unaware, unwilling or discouraged when it comes to changing a particular problematic behavior or condition. These individuals are usually under the impression that the behavior and/or problem are under control. Contemplators evaluate all the possibilities and consequences of change. They are actively engaged in an information search. Individuals in this stage still lack the commitment necessary for change in the near future. The preparation stage marks a time in which the person makes a conscious decision to take action in the near future and makes a firm commitment for change. Persons in the action stage are engaged in modifying their problematic behavior. They actively strive to interrupt habitual patterns and begin to exert control over their behavior by using different techniques. Strategies to avoid a relapse must also be discovered at this stage. Maintenance is the final stage where self-control over the behavior in question has become established.

The Transtheoretical Model of behavioral change as proposed by Prochaska (1991) includes relapses to previous stages as an integral part of the process of change. He states that a relapse does not mean the end of the process and suggests a spiral model of change over time. The model proposes that most people learn from their relapse experiences as they allow them to contemplate and prepare for further action. The model also suggests that an individual cannot enter into a subsequent stage without having completed the preceding stages. As far as patient education is concerned, this model should be used to encourage patients to progress through each stage of change, to relapse and recycle if necessary, to learn from these experiences, and to arrive eventually at a more stable stage of maintenance.

The application of these directives may enable the audiologist to formulate more effective assessment and treatment methods for adults with hearing impairment. Of particular interest in this regard is the assessment of health-related psychological well-being, the disablement process, the behavioral stage at which each client presents, and how hearing aid orientation programs interact with these important parameters.

This investigation will evaluate pre-fitting versus post-fitting counseling, in order to determine the most effective approach to expedite the specific behavioral changes (i.e., hearing aid use and communication strategies) necessary for improved communication through the use of amplification. Pre- and post-fitting counseling were evaluated for their effectiveness in relieving the psychosocial disablement of an individual with hearing impairment as well as for their educational capabilities regarding hearing aid use and communication strategies.

CHAPTER 2
REVIEW OF THE LITERATURE

Audiologic Rehabilitation / Hearing Aid Orientation Effectiveness

According to Kricos and Holmes (1996), audiologic rehabilitation efficacy research has focused on five areas: hearing aid benefit (e.g., Malinoff and Weinstein, 1989; Mulrow, Tuley, & Aguilar, 1992; Newman & Weinstein, 1988), hearing aid orientation (e.g., Brooks, 1979, 1989; Kapteyn, 1977; Surr, Schuchman, & Montgomery, 1978; Ward & Gowers, 1980; Ward, 1981), perceptual training (e.g., Gagne, Dinon & Parsons, 1991; Kricos, Holmes, & Doyle, 1992; Lesner, Sandridge & Kricos, 1987; Rubinstein & Boothroyd, 1987; Smaldino & Smaldino, 1988; Walden, Erdman, Montgomery, Schwartz, & Prosek, 1981) , listening training (e.g., Kricos et al., 1992; Rubinstein & Boothroyd, 1987), and counseling-based programs (e.g., Abrams, Hnath-Chisolm, Guerreiro, Ritterman, 1992). Audiologic rehabilitation through HAO has been shown to promote extended daily use and overall satisfaction with the hearing aid to the individual with hearing disability (Brooks, 1979, 1985; Holmes, 1995;

Kapteyn, 1977; Surr et al.,1978). The efficacy of pre-fitting HAO versus traditional post-fitting HAO in relieving hearing disablement and increasing levels of well-being has not been reported in the literature.

Current Methods of Evaluating Audiologic Rehabilitation

The use of various objective measures has been proposed for assessing the benefit of hearing aid use in the adult population. These methods include the use of speech perception testing in controlled environments, electro-acoustic measurements of the hearing aids in test boxes, and real ear measurements using a probe microphone in the patient's ear canal. Research supports the idea that the routine audiologic assessment, although objective, provides only limited insight to the communication difficulties encountered in the client's environment (Alpiner, 1987; Erdman & Demorest, 1998). A person-environment model may provide a more realistic focus when addressing patient needs. Current clinical measures, for example, performance tests used for fitting hearing aids, provide little value in predicting user benefit, especially over the long term. Given these limitations, it would appear that the most appropriate instrument for predicting long- term benefit would be a set of subjective responses to appropriately constructed questions which should relate directly to communication status and give guidance as to specific areas of difficulty and practical means of meeting individual needs (Brooks, 1990).

Subjective measures: Degree of disability/handicap assessment

Self perception or "measurement" of one's current condition with regards to disability from hearing loss has been established as a clinically relevant and accurate method of identifying areas in need of remediation (McCarthy, Montgomery, & Mueller, 1990). The Hearing Handicap Scale (HHS) developed by High, Fairbanks, and Glorig in 1964 was an early attempt to measure hearing handicap. Since the introduction of the HHS (High et al., 1964), many self-report scales for audiologic rehabilitation have been designed (Alpiner, Chevrette, Glascoe, Metz, & Olsen, 1974; Demorest & Erdman, 1987; Giolas, Owens, Lamb, & Schubert, 1979;

Kaplan, Bally, and Brandt, 1991; McCarthy & Alpiner, 1980; Newman & Weinstein, 1986; Noble & Atherly, 1970; Speaks, Jerger, & Trammel, 1970). These scales were designed to assess perceived levels of disability, patient and significant other attitudes and coping abilities toward hearing loss, communication performance in different environments, and hearing aid performance and use (Hutton, 1991; Schow, Balsara, Smedley, & Whitcomb, 1993). Although the HHIE, HHIA, and the SAC are recommended by the American Speech and Hearing Association (ASHA, 1997), the use of handicap scales has not been totally accepted in the field of audiology as valid measures of hearing aid user outcomes (Schow et al., 1993).

Various self-rating scales such as the HHIE (Ventry & Weinstein, 1982) are commonly used in current audiologic rehabilitation evaluations (McCarthy et al., 1990; Schow et al., 1993), particularly as a hearing aid fitting outcome measure. The current trend in the audiologic research community is to use such scales to measure changes in perceived handicap levels, as interpreted by the HHIE, to measure the effectiveness of therapy. Because of its commendable statistical characteristics and acceptance in the field of audiology, the HHIE has been widely used to assess hearing aid use in older adults (Malinoff & Weinstein, 1989; Newman & Weinstein, 1988).

One section of the HHIE measures emotion. This section assesses a client's attitudes and state of emotion with regard to his or her hearing loss. The social scale section of the HHIE evaluates perceived effects of hearing loss in a variety of situations. None of the items evaluate communication strategies, however, and only 13 items deal with attitudes related to hearing loss. This is surprising because the HHIE was designed to assess the social and emotional effects of hearing impairment on elderly persons (Kaplan, Bally, Brandt, Busacco, & Pray, 1997).

Findings by Jerger, Chmiel, Florin, Pirozzolo, and Wilson (1996) inadvertently reveal the lack of correlation between the HHIE and certain sociological measures. The sociologic measures used by Jerger et al.

(1996) were the Life Satisfaction in the Elderly Scale (LSES;Salamon & Conte,1986), the Affect Balance Scale (BradBurn,1969), and the Activity Scale (Graney & Graney, 1974). Jerger et al states an explanation as to why the subject's sociological measures did not change from pre-fitting to post-fitting. They state that "despite their hearing impairments, these subjects had not experienced any objective or subjective diminution of support from family and friends, which might be expected to impact not only their ability and opportunity to communicate with others but also their overall morale about relationships with other people" (Jerger et al., 1996). This statement echoes the definition of hearing handicap and lack thereof within the subjects, yet the HHIE showed a decrease in handicap score from pre-fitting to the 6-week re-administration of the test.

Hearing Aid Satisfaction and Benefit

The Client Oriented Scale of Improvement (COSI) was developed at the National Acoustic Laboratories of Australia (Dillon, James & Ginis, 1997). The clinician and client jointly complete a Patient Expectation and Perception Worksheet. Upon conclusion of the audiologic rehabilitation, the amount of benefit in the listening situations nominated by the patient can be determined by review of the patients' changes in disability ratings. The desirable outcome is that the dispenser and the patient agree on reasonable levels of satisfaction for each communication situation, and that these levels of satisfaction are met through the use of hearing aids.

The Glasgow Hearing Aid Benefit Profile (GHABP) is also designed to be a measure of individual client concern and expectation accountability (Gatehouse, 1997). With this questionnaire, the patient identifies up to eight listening situations that are difficult. For each situation, the patient rates the amount of difficulty, the level of annoyance, the proportion of time the patient's hearing aid is worn during the situation, the amount of help provided by the hearing aid, the level of difficulty in the situation with the hearing aid, and the degree of satisfaction with the hearing aid.

The COSI and the GHABP represent a more client-focused rehabilitation protocol. The importance of these tests is that they set up a paradigm in which the clients identify their own communication difficulties and then utilize the audiologist as a resource for solving these communication problems. This concept of patient empowerment has its theoretical basis in the work of educators and psychologists who have worked primarily with socially disadvantaged populations (Wallerstein & Bernstein, 1988). The empowerment philosophy is based on the idea that to be healthy, people must be able to bring about changes, not only personally, but also socially (Feste & Anderson, 1995). Rappaport (1987) defines empowerment as a "process by which people gain mastery over their lives."

Questionnaires

The use of questionnaires has proven to be the only means to evaluate the efficacy of different types of hearing aids and subsequent fittings when clinical measures failed to reveal any significance in benefit (Haggard, Foster, & Iredale, 1981). It would appear that the most appropriate instrument for predicting long term benefit would be a set of subjective responses to appropriately constructed questions which should relate directly to communication status and give guidance as to specific areas of difficulty and practical means of meeting individual needs (Brooks, 1990). This emphasizes the importance of addressing the person-environment perspective.

Haggard et al. (1981) followed a sample of hearing aid users over an 18-month period subsequent to issue. The authors allowed minor assistance and advice but no intensive hearing therapy or other instruction was given. A miniature timing device was installed in an aid to provide a check on self-reported extent of use. However, this is unreliable in that this device only accurately measures the amount of time the hearing aid is turned on and not how long the hearing aid is actually worn. Subjective measurement of hearing aid use has been shown to be reliable if you take into account that subjects tend to overestimate their amount of hearing aid use by approximately four hours a day (Humes, Halling, & Coughlin, 1996). On both objective and self-report measures, Haggard et al. Observed about half the aids being used over four hours per day. Despite modest improvements, at best, in aided word identification, questionnaire responses suggested reliable subjective benefits in specific listening situations. The idea that less than half of the hearing aid users received a ten-percent or greater word-identification improvement suggests that word recognition testing may not be a reliable measure of hearing aid benefit. This study is significant because it suggests the notion that the incorporation of time use in the field measures with subjective questionnaire measures may be a good representative measure of hearing aid benefit.

Oja and Schow (1984) provided a comprehensive follow-up protocol that was designed to assess benefit, use, and satisfaction from hearing aids. The benefit assessments included functional gain measures, and speech intelligibility in quiet and in noise. Hearing aid use was evaluated based on a questionnaire that asked for an estimate of daily use in hours and also an accounting of times when the aid was not in use during the day. Two use values were derived, an absolute daily use value and an adjusted percentage of use value. Satisfaction was assessed using a questionnaire.

Brooks (1990) made measurements using three aspects of aided performance that are employed in the overall assessment of outcome and benefit. They entail the amount of daily use the client makes of the aid, the level of satisfaction achieved, and a self-rating of the performance of the hearing instrument. These concepts are very closely related and often not easily defined. It is the sum of all three of these areas that more closely describe benefit. Brooks' study suggests that the evaluation of benefit obtained by a person with hearing-impairment from a hearing aid can be assessed with an acceptable degree of reliability. It would appear that use, satisfaction, and self-rated performance do relate to the user's perception of benefit from amplification. Brooks made several interesting inferences about his results that are of clinical significance.

Use of the 3-factor assessment in the individual allows the clinician to identify possible problem areas. Brooks claims that low satisfaction in association with good performance and use may be indicative of unrealistic expectations and further counseling may be in order. Likewise, poor performance ratings in conjunction with good use levels may suggest the need for hearing aid modification. Brooks also points out that the 3-factor method is amenable to statistical processing and that collection and tabulation are relatively easy making it a realistic clinical tool when assessing hearing aid benefit.

The use of this three-factor method was incorporated in a study conducted by Holmes & Kemker (1995). As a means of assessing patient outcome for hearing aid use and satisfaction, questionnaires were sent to 850 individuals who had received hearing aid services at the University of Florida, Department of Communicative Disorders, over the past four years. The questionnaire was a modified version of the Hearing Aid Review developed by Brooks (1990). The first 199 completed questionnaires have been analyzed. The number of patient visits was significantly correlated with subjects' reported satisfaction. This important finding indicates the need for more patient contact and follow-up services after the initial hearing aid fitting.

Perceived hearing aid benefit was assessed using an overall hearing aid satisfaction rating scale of 1 to 10 (1 = total dissatisfaction; 10 = total satisfaction) Two questions on hearing aid use and five questions related to self-perceived performance were used as the criteria to determine the cut off number on the satisfaction rating scale. If the subject responded positively to four out of seven questions, he/she was considered satisfied. Sensitivity of 83% and specificity of 81% was found when 5 was used to divide the satisfied and dissatisfied users on the perceived satisfaction scale. Fifty-six subjects rated their hearing aids ≤ 5 and 141 rated them >5. Two subjects did not answer this question.

Two variables were significantly correlated with user satisfaction. These were new vs. experienced users, and word recognition scores. Experienced hearing aid users were significantly more satisfied than new users. Word recognition scores above sixty-one percent were a significant indicator of hearing aid satisfaction. Moreover, individuals with word recognition scores between sixty-one and eighty percent had the highest rate of satisfaction. Hearing aid satisfaction was greatly reduced for scores below sixty percent.

One segment of the questionnaire asks the respondent to circle descriptors of their current feelings about their hearing aids. These words and phrases were grouped into four categories for statistical comparison to reported hearing aid satisfaction. These categories were: manipulation of the hearing aids, performance with the hearing aids, cosmetic concerns, and psychological aspects. All of the categories, with the exception of cosmetic concerns, had significant correlation with reported HA satisfaction. These results suggest that training on the manipulation (care and use) of hearing aids and counseling on dealing with hearing loss and repair strategies may increase satisfaction.

An important statistically significant finding was that the greater the number of patient visits, the more likely it was that the subject reported satisfaction. This indicates the need for more patient contact and follow-up services. Further, it highlights the importance of studying the time course of hearing aid use and the effects of formalized hearing aid orientation.

Parving and Phillip (1991) evaluated the use and benefit of hearing aids in 185 elderly hearing-disabled subjects. A questionnaire was mailed to the subjects four to six months after being fitted with hearing aids. Information from one hundred thirty eight, or roughly 75%, of the subjects responded to the questionnaire. The responders included 117 females and 21 males with a median age of 93 years (range 90-107). The questionnaire included questions concerning use of the hearing aid(s), self-reported benefit, handling problems, overall satisfaction/dissatisfaction, social and domiciliary situation, and self-reported visual capacity. Among the elderly subjects in Parving and Phillips study, 75% had previously been provided with hearing aids, while 25% were first-time users. The results of the questionnaire demonstrate that 76% use the hearing aid(s) at home and in small groups and those of these 51% use their hearing aid(s) each day. However, Parving and Phillip noted that 35% of the responders did not respond to the question regarding amount of daily use. Sixty four percent expressed "general satisfaction" with their hearing aid(s). Despite instruction and counseling, handling problems were frequently present as would be expected in this population of the elderly. In those previously fitted with hearing aids a higher rate of satisfaction and longer daily use was present. It was also observed that handling problems were less frequent than in the first-time users. With this type of specific information obtained from a questionnaire, clinical problems can be specifically addressed and user benefit can be realized.

Henrichsen, Noring, Christensen, Pedersen, and Parving (1988) remarked that the subjects applying for audiologic examination and rehabilitation are predominantly elderly people (i.e., 70 years or older). The questionnaire used by Henrichsen et al. (1988) examined the use and benefit of in-the-ear (ITE) hearing aids in the elderly hearing-impaired, and was compared with younger subjects and their use and benefit from in-the-ear hearing aids. An extensive questionnaire was sent six months after hearing aid fitting to all patients. Six hundred and ninety three (80%) subjects responded to the questionnaire. Results demonstrated that the elderly persons with hearing-impairment used the hearing aids predominantly when listening to television and in small groups. With this information, it would be easy to adjust clinical procedures to base hearing aid fittings around these two activities. Considering an auditory-visual means of information reception as opposed to auditory only may do this. Henrichsen et al. Also pointed out that 64% of the responders use their hearing aids the whole day and only 6% never use their hearing aids at all. Only 8% of the patients were dissatisfied with the cosmetic appearance of the hearing aids in this older age group. Not surprising, though, Henrichsen et al. Reported cosmetic dissatisfaction being more frequent in the young age group below 70 years than above the age of 70 years.

The use of questionnaires has proven to be an effective means to evaluate the efficacy of hearing aids. The use of subjective questionnaires can be a powerful means of measuring hearing aid benefit. Use, satisfaction, and self-rated performance appear to be a statistically valid assessment when incorporated with a questionnaire (Brooks, 1990).

Psychosocial measures: Psychological Well-being

In the past 100 years there has been a shift away from viewing health in terms of survival, through a phase of defining it in terms of freedom from disease, onward to an emphasis on the individual's ability to perform daily activities, and more recently to an emphasis on positive themes of happiness, social and emotional well-being, and quality of life. Documentation of the change in health of the individual with hearing impairment through amplification intervention has been somewhat elusive, partly because of the difficulties in determining what aspect of the global term "health" should be measured.

Recent literature suggests the term "quality of life" as being the measure of health that should be addressed when documenting outcome measures for audiologic rehabilitation (Jerger, et al., 1996). However, quality of life measures are nearly as broad as health assessment, encompassing general physical health status, education level, and financial resources. Therefore changes in communication as they impact quality of life may be immeasurably minute, indicating no change in status with regards to these parameters. This is evident in the Jerger et al.(1996) study in which they found the failure of any of the sociological measures used (i.e., Life Satisfaction Index, Affect Balance Scale, Social Activity Scale) to change after the use of amplification. Although these results may imply that a change in quality of life did not occur, one might interpret this as the change was not measured by the tests given. Currently available health measures of physical disability and handicap, social health, and quality of life are far too gross in their degree of measurement to indicate the effects of changes in communication on these areas (Jerger, et al.1996). Perhaps a more direct measure might be obtainable through the measurement of changes in an individual's psychological well-being from pre- to post-audiologic rehabilitation measurements.

Positive psychological well-being is indicated by the individual taking pleasure in his daily activities, finding life meaningful, reporting a feeling of success in achieving major goals, a positive self image and optimism (Neugarten, Havighurst & Tobin 1961). Psychological well-being scales can be grouped on a classification of measurement methods proposed by Campbell (1976). This taxonomy noted that early psychological well-being measurements were viewed largely as a cognitive process in which the individual compared his/her aspirations to his/her perception of his/her current situation. Well-being was seen in terms of life satisfaction.

One category of well-being scales involves recording affective responses to experience. One such group of scales is the four Single-Item Indicators of Well-being, as described by McDowell and Newell (1996). The four scales described by McDowell and Newell were chosen because they were the four most valid in the analysis of such scales by Andrews & Withey (1976). The conceptual basis for these tests as suggested by Andrews & Withey (1976) is that "quality of life is not just a matter of the conditions of one's physical, interpersonal, and social setting but also of how these are judged and evaluated by oneself and others." In the field of audiology we have long used these types of scales to rate hearing aid satisfaction. But in this context, these scales are used to assess the affective component of quality of life rather than the physical and social conditions in which a person lives. The following descriptions are taken from McDowell & Newell (1996). The four scales are:

1. The Delighted-Terrible Scale. This scale consists of seven points ranging from delighted to terrible. Respondents are told, "We want to find out how you feel about various parts of your life, and life in this country as you see it. Please indicate the feelings you have now taking into account what has happened in the last year and what you expect in the near future… How do you feel about ___?

2. The Faces Scale. This is a seven-point scale consisting of stylized faces ranging from a smiley face to a gloomy face. Respondents are told "Here are some faces expressing various feelings….Which face comes

closest to expressing how you feel about your _____?

3. The Ladder Scale. This scale is drawn as a vertical ladder with nine rungs. The top rung is labeled "Best I could expect to have" and the bottom rung, "worst I could expect to have." Respondents are told, "Here is a picture of a ladder. At the bottom of the ladder is the worst situation that you might reasonably expect to have. At the top is the best you might expect to have. The other rungs are in between….Where on the ladder is your_____? On which rung would you put it?" This scale is often termed self-anchoring because ratings are made relative to each person's conception of her own maximum and minimum life satisfaction.

4. The Circles Scale. Each of nine circles in this scale is divided into eight slices, each containing plus or minus signs. Circles are ordered from left to right so that they contain progressively more pluses and fewer minuses. The instructions read, "Here are some circles that we can imagine represent the lives of different people. Circle 0 has all minuses in it, to represent a

person who has bad things in his or her life. Circle 8 has all pluses in it, to represent a person who has all good things in his or her life. Other circles are in between.

Which circle comes closest to matching how you feel about ____?

These scales are advantageous in that they are easy to administer. More importantly, because of their non-verbal format, they may provide a more direct representation of feelings involved in well-being or morale than would a verbal translation of the response in a conventional question.

Another approach to measuring psychological well-being is via questions that screen for psychological distress. Distress is often the stimulus that provides the means for a person to present to the audiology clinic with a problem. The following measures do not make diagnostic classifications. Rather, they screen for signs of general psychological distress.

The Rand Mental Health Inventory (MHI) measures mental health in terms of psychological health and well-being, focusing on affective states (Stewart, Ware, & Sherbourne, 1992). The MHI focuses on mood and symptoms of anxiety and of loss of control over feelings, thoughts, and behavior. It would appear to be an appropriate inventory because it has incorporated the most statistically significant questions from a variety of past inventories (McDowell and Newell, 1996). The MHI also has been tested on thousands of people in the Rand Health Insurance experiment with good reliability and validity. The MHI is a 38-item self-administered inventory. Items refer to the past month. Most of the response scales have six options. To ensure comparability, the response options were kept close to those used in the questionnaires from which the items were originally drawn. Because of the length and awkwardness of scoring of this inventory, it may be beneficial to utilize one of the abbreviated forms. McDowell and Newell (1996) report that the abbreviated forms of the MHI perform well, citing a five-item version the (MHI5) as one of the best and most widely used. In this version the items are introduced by the question, "How much of the time during the last month have you….."

1. "… been a very nervous person?"
2. "… felt calm and peaceful?"
3. "… felt downhearted and blue?"
4. "… been a happy person?"
5. "… felt so down in the dumps that nothing could cheer you up?"

When a single-item screen for mental distress is required, a question from the MHI has been identified as being remarkable for this task. According to McDowell (1996), "Berwick et al. noted, the 'downhearted and blue' question identified nearly three quarters of those with any disorder in a primary care population, with a false positive rate of only 5%" (p. 175). This and other single screening items could at the very least be used as flag indicators in clinical situations.

Pre-fitting orientation/counseling

Brooks (1978) reviewed the effects of counseling on hearing aid use for patients in the National Health Service free hearing aid provision programs in Britain and Denmark. Marked differences were found between the countries. Brooks(1978), noted: "studies in Denmark (Ewertsen, 1974) suggest that over 50% of patients use their hearing aids for the major part of the day and only 6% do not use the aids at all, whereas in Britain (Brooks, 1976) only about 20% of patients use their aids at length with the percentage of non-users being about 12%" (p.1). Brooks (1978) suggested that the main reason for this difference is that all patients in Denmark receive some hours of counseling after the initial fitting, while in Britain counseling after the initial fitting of an aid was usually the exception rather than the rule. In 1978, Brooks developed an experimental program called the South Manchester Counseling Scheme. This study incorporated pre-issue, as well as post-issue, counseling. A control group received no counseling only standard dispensation of the hearing aid. The experimental group received the counseling regimen. Both groups were assessed by three methods. A small electronic device placed within the hearing aid measured the amount of hearing aid use by the patient. In addition, degree of social handicap was measured by the Weighted Index of Social Handicap (WISH) scale (Ewertson & Neilsen, 1973) at the time of initial fitting and eight to ten months later so that any reduction in handicap could be determined. Manipulation competency was the third method of assessment. Eight aspects of hearing aid use were addressed including the ability to insert the earpiece in the ear, to manipulate the volume control and switch, to correctly insert the battery, to change the hearing aid cord and to troubleshoot for minor problems. From this evaluation a 10-point rating scale of competence was determined. The overall conclusions of the study indicated that although the provision of the hearing aid alone produces some reduction in handicap, a much greater reduction appears to be achieved by providing some measure of counseling to the subjects. This study did not address the effects of pre-issue versus post-issue counseling.

In other medical fields, the effectiveness of pre-surgical education, training and counseling has been reported in several papers (e.g., Hathaway, 1986;

Mumford, Schlesinger, & Glass 1982; Webber, 1990). Specifically, Hathaway found that patients who receive taped, written, or verbal preparation generally required less pain medication post-surgery and recovered faster than patients who did not receive preoperative preparation. Mumford et al. found that prepared patients are often found to have a shorter length of hospital stay.

Pre-procedural education can reduce anxiety, increase coping ability, and shorten the hospital stays of surgical patients (Butler, Hurley, Buchanan & Smith-VanHorne, 1996). Butler et al. Evaluated pre-hospital education for total hip replacement (THR) surgery candidates and found the experimental group to have less anxiety and require less occupational therapy and physiotherapy than those who received no pre-education. The method of pre-procedural education was the administration of a simple information booklet mailer.

Purpose of the Present Investigation

Previous research has not addressed the effectiveness of a pre-fitting HAO. The success of pre-procedural counseling is well documented in other health-related fields in reducing anxiety and facilitating accelerated recovery from debilitation. The application of these findings to the field of audiology is a logical step.

There are many factors that may influence the success of any new hearing aid user. One major problem is individuals presenting with inappropriate expectations of hearing aid performance at the initial fitting (Kricos, Lesner, & Sandridge,1991). Kricos et al. (1991) recommended that the candidate receive frank counseling regarding realistic expectations for hearing aid benefits, actual use, and daily care of the hearing instrument. A pre-fitting HAO may be the appropriate vehicle to present this information. Thus, the purpose of this investigation is to evaluate the effectiveness of a pre-fitting HAO and to compare it to the traditional post-fitting HAO in affecting patient outcome.

Null Hypothesis or Key Question

Based on research dealing with HAO for the hearing impaired the following hypothesis and research directives were generated:

Null Hypothesis: there are no significant differences among an experimental group that will receive HAO counseling pre-hearing aid issue, an experimental group that will receive HAO counseling post-hearing aid issue, and a control group that will receive no HAO counseling in pre and post training measurements of psychological distress, affect and expectations/satisfaction.

Specific aim (1). To compare the effectiveness of a pre-hearing aid fitting HAO with the traditional post-hearing aid fitting HAO presentation to a control group, in providing hearing aid benefit.

Specific aim (2). To compare the effectiveness of pre-hearing aid fitting HAO and the traditional post-hearing aid fitting HAO, to a control group, in satisfaction of hearing aid use.

Specific aim (3). Develop an assessment battery capable of detecting changes in an individual's psychological well-being and relief of hearing disablement.

CHAPTER 3
METHOD

This investigation compared two presentation types of HAO with a control group receiving no HAO. The subjects were divided into three groups of 15 subjects each using a stratified random sampling scheme. Subjects then attended two one-hour pre-fitting HAO's, two one-hour post-fitting HAO's, or no HAO at all, depending on the group to which they were assigned.

Subjects

Forty-five subjects participated in this investigation. All subjects were solicited from the clinic population of the Department of Audiology and Speech Pathology at the Gainesville Veterans Administration Medical Center (GVAMC). Subject ages ranged between 60 to 80 years with a mean age of 70.70 years (see Table 1). Subject selection was based on the hearing loss criterion of a bilateral sensorineural hearing impairment with pure-tone thresholds poorer than

40 DB HL at 1000 or 2000 Hz in the better ear (Ventry and Weinstein, 1983). Pure tone averages (i.e. 500Hz, 1000 Hz, 2000 Hz) for subjects were 70 DB HL or better. Subject word discrimination scores at 40 DBSL were above 61 percent bilaterally. All subjects were native English speakers with adult onset hearing loss. All subjects were new hearing aid users, fitted with amplification upon inclusion in the study. Those patients being followed by the Visual Impairment Service Team (VIST) program within the VA system were not eligible for inclusion. Potential subjects were also screened using the Mini-Mental Status Examination (Folstein, Folstein, & McHugh, 1975) to rule out cognitive pathology as a possible confounding variable. A score of twenty-three or higher was required for inclusion into the study. Subject confidentiality was maintained by assigning a number to all participants.

Audiometric results for the three groups were consistent (see table 1). The Control group (*m*=72.06 years, *SD*=5.66 years) had three frequency (500 Hz, 1 KHz, 2 KHz) pure tone averages of 40.06 DBHL (*SD*=10.88 DBHL) and 38.06(SD=8.26 DBHL) for the right and left ears, respectively. High frequency (1 KHz, 2 KHz, 4 KHz) mean pure tone averages for the control group were 53.06 DBHL (SD=8.99 DBHL) and 51.86 (SD=6.98 DBHL) for the right and left ear, respectively as well. The speech reception threshold averaged mean was 32.93 DBHL (SD=7.70). The word recognition score averaged mean was 82.56 (SD=8.95). The Pre-fitting group (m=69.53 years, SD=6.09 years) had three frequency (500 Hz, 1 KHz, 2 KHz) pure tone averages of 36.13 DBHL (SD=9.82 DBHL) and 36.93(SD=8.51 DBHL) for the right and left ear, respectively. High frequency (1 KHz, 2 KHz, 4 KHz) mean pure tone averages for the pre-fitting group were 51.53 DBHL (SD=8.86 DBHL) and 53.13 (SD=6.81 DBHL) for the right and left ear respectively as well. Right and left averaged speech reception threshold means were 29.33 DBHL(SD=9.37). Word recognition score means were 78.80 (SD=9.31). The post-fitting group (m=70.28 years, SD=5.63 years) had three frequency (500 Hz, 1 KHz, 2 KHz) pure tone averages of 38.73 DBHL (SD=8.74 DBHL) and 37.40(SD=7.95 DBHL) for the right and left ear, respectively. High frequency (1 KHz, 2 KHz, 4

KHz) mean pure tone averages for the post-fitting group were 54.27 DBHL (SD=8.98 DBHL) and 52.93 (SD=9.68 DBHL) for the right and left ear, respectively as well. The speech reception threshold averaged mean was 30.53 DBHL (SD=5.50). The word recognition score averaged mean was 85.71 (SD=8.41).

Table 1. Group Age and Audiometric results.

	Pre-fitting	Post-fitting	Control
Age	m=69.53 SD=6.09	m=70.28 SD=5.63	m=72.06 SD=5.66
PTA (rt)	m=36.13 SD=9.82	m=38.73 SD=8.74	m=40.07 SD=10.88
PTA (lft)	m=36.93 SD=8.51	m=37.40 SD=7.95	m=38.06 SD=8.26
HFPTA(rt)	m=51.53 SD=8.86	m=54.27 SD=8.98	m=53.07 SD=8.99
HFPTA(lft)	m=53.13 SD=6.8	m=52.93 SD=9.68	m=51.87 SD=6.98
SRT	m=29.33 SD=9.37	m=30.53 SD=5.50	m=32.93 SD=7.70
PBMAX	m=78.80 SD=9.31	m=85.71 SD=8.41	m=82.56 SD=8.95

Instrumentation

All subjects had an audiologic evaluation completed including standard pure tone air and bone conduction testing, speech reception thresholds, and word recognition testing. Testing was completed by a certified audiologist using a diagnostic audiometer (Grason Stadler model 1710) under headphones (model TDH 50P) in a double-walled test chamber (Tracoustics model RS 254 BS) meeting American National Standards Institute {ANSI} code S3.1-1991. Speech testing including speech reception thresholds and word recognition was completed using a compact disc player (TEAC model PD 80 mkII*)* routed through the audiometer. Otoscopic inspections were performed on all subjects prior to testing.

For all hearing aid fittings the National Acoustic Laboratories Revised version (NAL-R) target gain measures was used. This formula for target gain is the standard procedure for hearing aid fittings at the GVAMC.

All equipment was calibrated to meet the standards of the American National Standards Institute (ANSI; S3.6-1989; ANSI S3.1-1991). Daily listening checks were performed throughout the experiment.

HAO content

The design of the hearing aid adjustment program that was used in this study, is a modification of one developed by Holmes at the University of Florida (see Appendix B). It is a combination of communication skills training and HAO. Nonverbal and situational cues are addressed as well as information on environmental modifications to facilitate best possible listening situations. Expressive skills, which enable individuals with hearing impairment to communicate their needs to others in an assertive, non-threatening manner is also part of this protocol. The subjects received information and were counseled on their specific hearing impairment and needs. This included basic anatomy and physiology, the audiogram, and how these topics apply to their personal hearing concerns. Care and proper maintenance of the hearing instrument were covered in detail. A one-on-one counseling session took place, for the experimental subjects, in the conference room at the GVAMC Audiology and Speech Department.

Each patient receiving HAO was also give a written packet of materials that went along with the sessions. The patient packet is in Appendix A and contains the following:

1. An outline describing what was covered in the HAO.
2. A list of contacts for resource materials. Subjects were informed that they could contact any of these resources for more information and support regarding their hearing loss.
3. A short list of recommended books that can be obtained through a bookstore or checked out at the local library.
4. HAO Outline:
   - A. Hearing Loss:
     1. Basic anatomy of Hearing:

        A diagram of outer, middle, and inner ear anatomy. The diagram is labeled for review of major structures to familiarize the patient with basic anatomy and terminology. This will allow patients to better discuss their hearing condition with a physician or audiologist.
     2. What causes Hearing loss:

        A basic explanation of the types of hearing loss are outlined and each subject will then be asked to identify his/her hearing loss as conductive, sensorineural, or mixed. These categories are described on page five.

3. Understanding an audiogram:

   A. Generic audiogram. A basic explanation of the numbers relative to loudness and pitch is detailed. Further understanding of the audiogram is continued on page seven. This diagram links the subject's understanding of loudness and pitch to how this applies to speech energy. Finally, page eight combines speech energies with everyday familiar sounds. Subjects may be asked to describe one of the diagrams in terms of loudness and pitch to ensure their understanding.

B. Hearing Aids:

1. What hearing aids can and can not do

Page nine of the handout is a list of communication strategies. The list is designed to present these communication strategies from a hearing aid limitation perspective. The audiologist and participant will discuss each item on the list.

Page ten introduces factors reducing hearing aid performance. This list introduces environmental factors that reduce communication performance. Again this topic is approached regarding hearing aid limitations, learning to recognize these situations, and how to resolve these difficulties.

2. How to use your hearing aids

The diagram on page eleven points out all of the necessary components of a BTE and an ITE. Hearing aid manipulation with regard to proper insertion, volume and telecoil use, and battery information was discussed.

3. How to take care of your hearing aid

Page twelve through fourteen lists some recommended items and procedures necessary for basic hearing aid maintenance. Each item was reviewed and discussed.

Procedure

Three groups of 15 subjects each were selected using a systematic random sampling scheme. Word recognition scores of subjects were monitored for each group to insure balancing. At the time of the making of earmold impressions at the GVAMC audiology clinic, all veterans agreeing to take part in the study completed the Mini-Mental Status Examination (Folstein et al. 1975). The subject then was administered the following items that were randomized to eliminate any fatigue factors or order effects:

1. MHI5 (pencil/paper format) administered on a clipboard and filled out in the GVAMC sound booth.
2. The four Single-Item Indicators of Well-being (pencil/paper format) administered on a clipboard and filled out in the GVAMC sound booth.
3. GHABP (interview format) administered verbally in the audiology test booth by the author.

The control group received no HAO. The other two groups received the same HAO series consisting of two one-hour sessions. One of these groups received the last of the HAO sessions at least one week pre-issue, while the other of these groups will receive the last of the HAO sessions at least one week post-issue. The two HAO sessions were administered approximately one week apart from each other. The control group was offered the opportunity to attend a HAO after this study had been completed. The HAO sessions were administered by the same two audiology graduate students for all groups while not being aware of the specific goals of the investigation. The GVAMC secretary throughout the course of the study recorded the number of patient contacts per subject. The administration of the final assessment took place within four to five weeks from the time of initial hearing aid fitting. Assessment included a randomized version of the following:

1. MHI5 (see Appendix A; pencil/paper format).
2. The four Single-Item Indicators of Well-being (pencil/paper format).
3. GHABP (interview format).
4. The modified version of the Brooks Questionnaire (pencil/paper format).
5. Hearing aid manipulation screener administered by author. (see Appendix A)

CHAPTER 4
RESULTS

For each group, pre-fitting and post-fitting assessments were compared statistically (Appendix C). Each HAO group was also compared to the control group. The following null hypothesis was tested: there are no significant differences among an experimental group that will receive HAO counseling pre-hearing aid issue, an experimental group that will receive HAO counseling post-hearing aid issue, and a control group that will receive no HAO counseling in pre and post training measurements of psychological distress, affect and expectations/satisfaction.

Statistical Methods

The study design consisted of a randomized, double-blinded, 3-arm trial. Patients in the study were randomized to one of 3 treatment groups with balanced group allocation (n = 15 per group). One patient ultimately was excluded from the study due to the occurrence of unusual circumstances during his participation in the study. (certain extraneous events escalated this individual to social celebrity status after pre-fitting measures were obtained and before post-fitting measures were completed). Baseline characteristics of interest and baseline levels of certain outcome measures were determined for each subject prior to the start of the study. Outcome variables of interest were assessed only after patients completed their respective study group protocols. Simple summary statistics and pairwise Pearson and Spearman correlations among response variables and baseline covariates were initially considered along with clinical relevance and importance in arriving at a final subset of covariates and outcome measures to be used in the analysis (Snedecor & Cochran, 1980). Outcome variables which were analyzed rigorously included the Hearing Aid Manipulation Screener (HAMS) time, items 3, 4, 5, and 6 from the Glascow Hearing Aid Benefit Profile (GHABP) scoring instrument, items 4, 10, 11, and the sum of items 7, 8, and 9 from the Brooks Questionnaire, the total score from the Rand Mental Health Index (MHI5), and the ladder instrument score. Hearing aid fitting audiologist, age, both-ear averages for SRT and PBMax, item 1 from the GHABP (the pre-fitting analogue of item 5), item 2 from the GHABP, baseline assessments of the MHI5 total score and ladder score were each considered as potential confounders or moderators of treatment effect.

Differences in outcome measures between experimental groups were evaluated in the context of several different statistical models. Analysis of covariance (ANCOVA) was used to compare group means adjusted separately for each baseline covariate of interest (parallel slopes model) and also to determine if differences among group means depended on the level of the baseline covariate being considered (nonparallel slopes model)(Fleiss, 1986). Given the study design and sample size, covariates were only considered individually with regard to their influence as confounders or moderators of treatment effect so as to avoid possible overfitting of the data. Analysis of variance (ANOVA) was used to compare unadjusted response means among the experimental groups. For each response variable, preliminary model fitting was carried out so that residuals from the model fit could be assessed for distributional normality and the presence of any systematic pattern of variation, which could be removed by transformation. This residual analysis indicated that the distributional properties of the HAMS time improved with inverse transformation, while item 3 from the GHABP, items 4 and 11 from the Brooks Questionnaire, and the ladder score appeared to benefit from arcsine-square root transformation. The within-subject Pearson correlation between pre- and post-study determinations of several of the outcome variables was also evaluated in order to decide if the post-study determination or the difference between pre- and post-study determinations would be the more appropriate form to analyze. A correlation coefficient greater than 0.5 favored the difference score, while a correlation coefficient less than 0.5 favored the post-study score). These correlations were such that the difference between items 1 and 5 from the GHABP (pre-versus post-study $\underline{r}$=.54) and the MHI5 difference score (pre- versus post-study $\underline{r}$=.65) were used in the analysis, while the arcsine-square root-transformed post-study ladder score (pre- versus post-study r=.32) was used.

The significance of interactions between group and covariate effects in the nonparallel slopes ANCOVA model and group main effects in the parallel slopes ANCOVA and ANOVA models were all assessed by F test (Fleiss, 1986). Tukey's pairwise multiple comparison procedure was used to evaluate pairwise differences among group means while maintaining an experiment-wise significance level of 0.05 (Fleiss,1986). When a significant interaction between covariate and group effects was detected, the covariate cutpoint was determined above or below which a pairwise difference between group means first became significant at a Tukey-adjusted significance level of 0.05. Final model fits were all evaluated for highly influential observations or outliers using Cook's distance, a measure of the relative change in model regression coefficients which would occur if a particular observation were removed (Weisberg, 1980). Observations demonstrating a Cook's distance >1 were considered to be highly influential and thus suspicious. Patient data values were rechecked for validity in this situation, and models were refit with the influential observation excluded in order to characterize the nature of the influence. R-squared was also calculated for each model fit to determine the percent of variability in the outcome measure accounted for by each model.

One outcome variable, the sum of items 7, 8, and 9 from the Brooks Questionnaire, could not be analyzed via ANCOVA or ANOVA models because of distributional properties (one patient had a value of 1, while all other patients had values of 2 or 3). A new binary outcome variable was thus constructed by classifying patients as having a score of 3 for the original outcome measure or as having a score less than 3. Logistic regression models analogous to the nonparallel and parallel slopes ANCOVA models and the ANOVA model were then used to analyze this binary response variable and the influence of covariates as confounders or moderators of treatment effect (Selvin, 1991).

Effect of Audiologist

No significant interactions between group and audiologist effects at an alpha level of 0.05 were observed for any of the response variables analyzed, indicating that differences in group means did not depend on audiologist.

Hearing Aid Manipulation Screener

Table 2. simple summary statistics for the HAMS. Time in seconds.

Group	N	Mean	SD	Median	Min	Max
Control	15	40.26	19.59	34.00	21.00	92.00
Pre-	15	35.93	29.50	25.00	20.00	132.00
Post-	14	37.35	20.43	32.50	25.00	106.00

No significant differences were observed among HAMS Time group means in either parallel or nonparallel slopes ANCOVA models (see table 2 and Appendix C). The previously described pattern did not change when controlled for initial disability (GHABP1) and perceived hearing handicap (GHABP2).

Gatehouse Hearing Aid Benefit Profile difference of items 5 and 1 (GHABP5-1) (difference score)

Items 1 and 5 on the GHABP are designed to reflect *initial* and *residual disability* of the patient respectively. Each patient was asked to address the first item on the GHABP. This item pertained to the patient's unaided listening difficulty in specific situations and was administered at the time the ear molds were cast. Approximately one month post-fitting, the patient was asked to answer question number five, which is actually a re-asking of question number one after the introduction of hearing aids. The difference score from these items was analyzed and is denoted in this text as (GHABP5-1; see table 3). Statistical analysis results can be found in Appendix C.

Table 3. The summary statistics for the GHABP5-1.

Group	N	Mean	S.D.	Median	Min	Max.
Control	15	-37.91	11.48	-37.50	-60.00	-18.75
Pre-fit	15	-45.25	12.13	-43.75	-75.00	-25.00
Post-fit	14	-35.05	21.33	-33.12	-66.66	0.00

No significant differences were observed among unadjusted GHABP5-1 difference score group means (Table 3). Group means did differ significantly when adjusted for GHABP1 in a parallel slopes ANCOVA model (group main effect p= 0.040), with (pre-fitting HAO) demonstrating a significantly greater mean decrease in score than the control group. However, residual analysis indicated that the observation for the aforementioned "celebrity" subject, exerted a significant influence on model parameter estimates (Cook's distance for this observation was 1.10). Refitting the parallel slopes ANCOVA model with this patient excluded yielded a marginally significant GHABP1-adjusted group main effect (p= 0.0746) and a marginally significant difference in means between the pre-fitting group and the control (p= 0.061). These results reveal that patients receiving pre-fitting counseling showed slightly greater improvements regarding situational listening difficulties when compared to the control group, with no significant differences observed in the post-fitting group.

Age-dependent and PreMHI5T-dependent differences among GHABP5-1 group means were observed in nonparallel slopes ANCOVA models [$\underline{p}=0.027$ and $\underline{p}=0.029$ respectively for (age x group) and (PreMHI5T x group) interaction effects]. The post-fitting group showed a significantly lower residual disability score as compared to the pre-fitting and control groups. This was evident when subjects were $\geq$ 77 years old or had PreMHI5 scores $\geq$ 27(maximum score on the PreMHI5 = 30). Another statistically significant reduction in disability as measured by the GHABP5-1, was found when the subjects were $\geq$ 73 or had PreMHI5 scores of $\geq$ 24. However, these age-dependent and PreMHI5T-dependent differences among GHABP5-1 group means became non-significant after controlling for GHABP1 and GHABP2 simultaneously (Table 4).

Table 4. GHABP1+2-adjusted GHABP5-1 group means controlling for AGE

AGE

Group	Mean	SE	Lower95	Upper95
0	-34.54	2.54	-39.69	-29.39
1	-44.15	2.47	-49.16	-39.14
2	-39.86	2.62	-45.16	-34.55

PreMHI5T

Group	Mean	SE	Lower95	Upper95
0	-34.63	2.51	-39.70	-29.55
1	-44.10	2.47	-49.10	-39.10
2	-39.81	2.63	-45.13	-34.49

PreLadder-dependent differences among GHABP5-1 group means observed in a nonparallel slopes ANCOVA model were only marginally significant (p=0.057), with the post-fitting group demonstrating a lower mean decrease in score than pre-fitting and control groups in patients with a PreLadder score of 9 (p=0.056 and 0.059 respectively; maximum PreLadder score =10. The previously described pattern did not change when controlled for initial disability (GHABP1) and perceived hearing handicap (GHABP2).

Gatehouse Hearing Aid Benefit Profile Item 3 (GHABP3) and the Modified Brooks Questionnaire item 4(BQ4) (both arcsine-square root transformed)

The third item on the Gatehouse Hearing Aid Benefit Profile (GHABP3), and the fourth item on the Modified Brooks Questionnaire (BQ4), refer to the amount of time the patients spend wearing their hearing aids. No significant differences were observed among unadjusted GHABP3 or BQ4 group means nor among group means adjusted separately for each covariate of interest in parallel slopes ANCOVA models (table 5). Similarly, no significant covariate-dependent differences were observed among group means in nonparallel slopes ANCOVA models that included the same covariates. The previously described pattern did not change when controlled for initial disability (GHABP1) and perceived hearing handicap (GHABP2). Statistical results can be found in Appendix C.

Table 5. Simple summary statistics showing patient hearing aid use.

Variable	Group	N	Mean	SD	Median	Min	Max
GHABP3	control	15	85.50	14.64	87.50	56.25	100.00
	Pre-	15	88.69	12.75	93.75	62.50	100.00
	Post-	14	83.51	26.34	95.83	25.00	100.00
BQ4	control	15	2.66	1.04	2.00	1.00	4.00
	Pre-	15	2.73	0.96	2.00	2.00	4.00
	Post-	14	2.85	1.09	2.50	1.00	4.00

Gatehouse Hearing Aid Benefit Profile Item 4 (GHABP4)

The fourth item on the GHABP offers a means to assess hearing aid benefit (table 6). No significant differences were observed among unadjusted GHABP4 hearing aid benefit group means nor among group means adjusted separately for each covariate of interest in parallel slopes ANCOVA models. Similarly, no significant covariate-dependent differences were observed among group means in nonparallel slopes ANCOVA models which included the same covariates. The previously described pattern did not change when controlled for initial disability (GHABP1) and perceived hearing handicap (GHABP2). Statistical results can be found in Appendix C.

Table 6. Simple summary statistics showing patient hearing aid benefit.

Variable	Group	N	Mean	SD	Median	Min	Max
GHABP4	control	15	57.55	9.84	60.00	31.25	68.75
	Pre-	15	63.38	14.57	65.00	29.16	83.33
	Post-	14	62.44	18.72	65.62	25.00	100.00

Gatehouse Hearing Aid Benefit Profile item 6 (GHABP6)

The sixth item on the GHABP provides a measure of patient hearing aid satisfaction (table 7). No significant differences were observed among unadjusted GHABP6 group measures of hearing aid satisfaction nor among group measures of hearing aid satisfaction adjusted separately for each covariate of interest in parallel slopes ANCOVA models. Age-dependent and GHABP1-dependent differences among group measures of hearing aid satisfaction were observed in Nonparallel slopes ANCOVA models (p=0.026 and 0.031 respectively for (age x group) and (GHABP1 x group) interaction effects). In patients $\leq$ 66 years of age, mean hearing aid satisfaction was significantly higher in the post-fitting group when compared to the control. The post-fitting group's mean hearing aid satisfaction was also significantly greater than the control group's hearing aid satisfaction in patients whose GHABP1 (initial disability) score was $\geq$ 70%. Mean hearing aid satisfaction was significantly greater in the pre-fitting group when compared to the control patients whose initial disability (GHABP1) score was $\geq$ 64%. The previously described pattern did not change when controlled for initial disability (GHABP1) and perceived hearing handicap (GHABP2). Statistical results can be found in Appendix C.

Table 7. Simple summary statistics showing patient hearing aid satisfaction.

Variable	Group	N	Mean	SD	Median	Min	Max
GHABP6	control	15	62.44	13.11	65.00	25.00	75.00
	Pre-	15	67.58	10.16	66.66	50.00	93.75
	Post-	14	65.68	12.48	68.33	37.50	81.25

Modified Brooks Questionnaire item 10(BQ10)

The tenth question on the modified Brooks questionnaire addresses the patient's hearing aid benefit in specific listening situations (Table 8). No significant differences were observed among unadjusted

BQ10 group measures of benefit in specific listening situations nor among group measures of benefit in specific listening situations adjusted separately for each covariate of interest in parallel slopes ANCOVA models. GHABP1-dependent and PreMHI5T-dependent differences among group measures of benefit in specific listening situations were observed in nonparallel slopes ANCOVA models (p=0.050 and 0.047 respectively for GHABP1 x group and PreMHI5T x group interaction effects). Patients whose GHABP1 score was ≥79% had significantly higher BQ 10 mean benefit scores in the post-fitting group compared to the control group. The post-fitting group's mean benefit score was also significantly greater than the control group's mean score in patients whose PreMHI5T score was ≤16. See Appendix C for statistics.

GHABP2-dependent differences among group means were also observed in nonparallel slopes ANCOVA models (p=0.043) Mean BQ 10 scores were significantly higher in the post-fitting group compared to the control group when GHABP2 was ≥75%. See Appendix C for statistics.

Table 8. Simple summary statistics showing patient benefit in specified listening situations.

Variable	Group	N	Mean	SD	Median	Min	Max
BQ10	control	15	19.53	3.52	19.00	14.00	25.00
	Pre-	15	20.20	2.73	20.00	16.00	24.00
	Post-	14	20.14	4.05	20.50	13.00	25.00

Modified Brooks Questionnaire item 11 (BQ11) (arcsine-square root transformed)

The eleventh question on the modified Brooks questionnaire measures overall satisfaction (table 9). No significant differences were observed among unadjusted mean BQ11 group satisfaction ratings nor among group satisfaction means adjusted separately for each covariate of interest in parallel slopes ANCOVA models (Appendix C). Only marginally significant PreMHI5T-dependent differences among group measures of overall satisfaction were observed in a nonparallel slopes ANCOVA model ($p=0.062$ for the PreMHI5T x group interaction effect; Appendix C). The overall mean satisfaction rating was higher in the post-fitting group compared to both the control and pre-fitting groups when PreMHI5T score was $\leq$ 12, although both comparisons were only marginally significant ($p= 0.079$ and 0.064 respectively). The previously described pattern did not change when controlled for initial disability (GHABP1) and perceived hearing handicap (GHABP2).

Table 9. Simple summary statistics showing patient hearing aid overall satisfaction.

Variable	Group	N	Mean	SD	Median	Min	Max
BQ11	control	15	8.20	1.82	8.00	3.00	10.00
	Pre-	15	8.26	1.62	9.00	5.00	10.00
	Post-	14	8.71	1.32	9.00	7.00	10.00

Rand Mental Health Inventory. Five item version (MHI5). PostMHI5T-PreMHI5T (difference score)

Analysis of change in the 5-item Rand Mental Health Inventory, a measure of psychological well-being, associated with the introduction of hearing aids revealed no significant differences among unadjusted MHI5 difference group measures of psychological well-being nor among group measures of psychological well-being adjusted separately for each covariate of interest in parallel slopes ANCOVA models (Appendix C). Similarly, no significant covariate-dependent differences were observed among group measures of psychological well-being in nonparallel slopes ANCOVA models which included the same covariates. The previously described pattern did not change when controlled for initial disability (GHABP1) and perceived hearing handicap (GHABP2).

Post-Ladder (arcsine-square root transformed)

The four measures of psychological well-being evaluated in this study performed consistently i.e. none of the scores provided useful information As it turned out, none were effective in revealing changes in psychological well-being. The Ladder scale was selected to represent this group of tests that included; the Faces Scale, The Delighted/Terrible scale, the Circles scale, and the Ladder scale. No significant differences were observed among unadjusted GHABP3 group means nor among group means adjusted separately for each covariate of interest in parallel slopes ANCOVA models (Appendix C). Similarly, no significant covariate-dependent differences were observed among group measures of psychological well-being in nonparallel slopes ANCOVA models which included the same covariates. The previously described pattern did not change when controlled for initial disability (GHABP1) and perceived hearing handicap (GHABP2).

CHAPTER 5
DISCUSSION

This chapter is divided into five sections. In the first section, findings which concern the subjects' familiarity and ability to manipulate the hearing aid will be discussed. In the second section, findings pertaining to measures of disability and handicap will be discussed. Findings related to the subjects' perception of hearing aid benefit and satisfaction are addressed in the third section. In the fourth section, findings which concern measures of subject affect response or psychological well-being will be discussed. The fifth section summarizes the findings addressed in previous sections and provides direction for further research.

Hearing Aid Manipulation Screener (HAMS)

Statistically significant differences in mean HAMS time among groups were not found. However, observed group means revealed a noteworthy trend. Individuals from the pre-counseling group performed with the fastest times (m = 35.9 sec), followed by the post-counseling group (m = 37.5 sec) with the control group having the longest time on average (m = 40.2;See Table 2).

Gatehouse Hearing Aid Benefit Profile(GHABP)

The GHABP is a clinical tool capable of evaluating various aspects of clinical procedure while maintaining clinical suitability and utility. While maintaining a client-driven agenda, it is designed to provide numerical outcome measures for quality assurance and also in developing individual patient audiologic management strategies.

Initial and residual perceived handicap (Ghabp5-GHABP1 difference score)

Patients receiving pre-fitting counseling showed slightly greater improvements regarding situational listening difficulties when compared to the post-fitting and control groups. These results suggest that client familiarity and competency with the hearing instrument may be obtained more efficiently with pre-fitting counseling than with the traditional no counseling and post-fitting counseling regimes. This may not suggest that pre-fitting counseling is actually better, but rather, client exposure to hearing instrument care and use strategies should be expedited, once hearing aid intervention is pursued. It is unclear whether these differences would be observed six months post-fitting, and warrants further investigation.

Age-dependent and Pre-fitting Mental Health Index total(PreMHI5T)-dependent differences among GHABP5-1 group means were observed. The post-fitting group demonstrated significantly higher psychological well-being scores than the pre-fitting and control groups in patients $\geq$73 years of age with a PreMHI5T score of $\geq$24. This suggests that considering age may be important when regarding the consequences and sensitivity to psychological distress and well-being of a client with hearing impairment.

The MHI5 shows promise as a pre-fitting screening tool to identify clients who would need to attend a mandatory HAO to ensure hearing aid use and satisfaction. Likewise, the MHI5 would also identify those clients who may attend HAO on a voluntary basis. Consideration of this measure might thus, result in a more cost and time effective counseling program in the clinical setting.

Re-evaluation of age and PreMHI5 while simultaneously controlling for initial disability (GHABP 1) and perceived handicap (GHABP 2) revealed that their influence on differences among GHABP5-1 group means became non-significant. This may suggest that if in any way we can successfully identify individual patient disability and perceived handicap through intervention, that age and psychological distress effects can be more effectively addressed.

Amount Of Time The Patient Spent Wearing Their Hearing Aids (GHABP3 and BQ4)

The third item on the GHABP (GHABP3), and the fourth item on the Modified Brooks Questionnaire (BQ4), refers to the amount of time the patient spent wearing their hearing aids. No significant differences were observed among the control, pre-fitting and post-fitting groups using these measures. The homogeneity of this cohort may have considerable influence on the amount of time the patient wears their hearing aids. Outstanding patient compliance and cooperation from this age group of veterans should be noted. All of the subjects do receive their healthcare and hearing aids free. This may be an uncontrollable condition possibly responsible for creating elevated subject response. Also, one-month post-fitting measures may possibly still be within the "honeymoon" period. A longitudinal study measuring the amount of time the patient wears their hearing aids, in this and other "fee-for-service" populations, is warranted.

Hearing Aid Benefit (GHABP4)

The fourth item on the GHABP offers a means to assess hearing aid benefit. No significant differences were observed among the three experimental groups. It cannot be ruled out that free acquisition of hearing aids rendered the measurement tools used in this study insensitive to these elevated differences in hearing aid benefit between groups.

Patient Hearing Aid Satisfaction (GHABP6)

The sixth item on the GHABP offers a means to assess patient hearing aid satisfaction. Patients less than 66 years of age in the post-fitting group were significantly more satisfied with their hearing aids than those in the control group and slightly more so than the pre-fitting group. It would appear that the timing and type of HAO provided are well received by this age group. Different counseling methodologies should be investigated regarding those individuals above the age of 66 years. The post-fitting group mean was also significantly greater than the control group mean in those patients whose GHABP1 score was > = 70%. Patient hearing aid satisfaction was significantly greater in pre-fitting group compared to the control group in those patients whose GHABP1 (initial disability) score was $\geq$64%. This suggests that patients with greater initial disability, as identified by the

GHABP, receive significant satisfaction from pre-fitting and/or post-fitting counseling as compared to patients receiving no counseling. Further investigations targeting elevated initial disability scores as part of the inclusion criteria would reduce ceiling effects.

BQ10

The tenth question on the modified Brooks questionnaire addresses patient benefit in specific listening situations (Table 7). No significant differences were observed among unadjusted BQ10 group measures of satisfaction in specific listening situations nor among group measures of benefit in specific listening situations. However, when the initial disability (GHABP1) scores were included in the analysis, patients in the post-fitting group with higher measures of initial disability showed significantly greater benefit when compared to the control with unremarkable differences in hearing aid benefit when compared to the pre-fitting group. The post-fitting group's benefit scores were also significantly greater than the control group's satisfaction scores in patients whose PreMHI5T score was ≤16. Post-fitting group subjects with poor MHI5 scores (≤16), reflecting compromised feelings of psychological well-being, showed greater benefit with the hearing aid in specific listening situations than did the control. The pre-fitting group was more pleased with their hearing aids in specific listening situations than the control, but not to a significant degree. Use of the MHI5 as an inclusion criteria in combination with the GHABP would insure the investigator a subject base who would benefit from counseling. Likewise, clinical application of these two screeners in combination would identify those clients requiring HAO to ensure hearing aid benefit.

BQ11 (arcsine-square root transformed)

No significant differences in satisfaction were observed among unadjusted BQ11 group means nor among group means adjusted separately for each covariate of interest in parallel slopes ANCOVA models. It is noteworthy that the pre-fitting and post-fitting groups did have higher satisfaction ratings than the control (table 8).

The four single-item measures of psychological well-being

The four single-item measures of psychological well-being used performed consistently. These measures failed to detect differences suggesting that the degree of disablement as a group was minimal. This conclusion may be misleading in that it could reflect the subjects' adaptation to their disablement by withdrawing from communication situations. Support for this was found by Jerger et al (1996) when they stated that "despite their hearing impairments, these subjects had not experienced any objective or subjective diminution of support from family and friends, which might be expected to impact not only their ability and opportunity to communicate with others but also their overall morale about relationships with other people." The implications of this may better describe the cohort these subjects represent and their communicative role in current American society than on individual relief from disablement. It is possible that to avoid the handicapping effects of hearing loss, people in this age group (60-80yrs) adapt their communicative and subsequently social role as a means of coping with the disablement of a hearing loss. Measure of changes in social activity may be a more accurate measure of psychological well-being for populations suffering from the long term effects of hearing impairment.

Conclusions

The results of the Hearing Aid Manipulation Screener suggest that not only does HAO in general improve hearing aid manipulation ability, but pre-fitting counseling may be a more appropriate time for hearing aid manipulation instruction.

The post-fitting group demonstrated significantly higher psychological well-being scores than the pre-fitting and control groups for patients ≥ 73 years of age or with a PreMHI5T score of ≥ 24. The sixth item on the GHABP offers a means to assess patient hearing aid satisfaction. Patients less than 66 years of age in the post-fitting group were significantly more satisfied with their hearing aids than those in the control group and slightly more so than the pre-fitting group.

Patients with greater initial disability, as identified by the GHABP1, receive significant benefit from pre-fitting and/or post-fitting counseling compared to patients receiving no counseling. Post-fitting group subjects with poor MHI5 scores ($\leq$ 16), reflecting compromised feelings of psychological well-being, showed greater benefit with the hearing aid in specific listening situations (BQ10) than did the control. The pre-fitting group was not significantly more pleased with their hearing aids in specific listening situations than the control. It is noteworthy that the pre-fitting and post-fitting groups did have higher satisfaction ratings (BQ11) than the control (Table 8), but these differences were not significant.

The four single-item measures of psychological well-being failed to detect differences among groups suggesting that the degree of disablement was minimal.

And lastly, this study showed that the MHI5 may be a good indicator of psychological distress or well-being.

Recommendations for future studies

Traditional protocol for the elderly client with hearing impairment has been one of voluntary post-fitting HAO. The results of this study demonstrate the advantages of both pre- and post-fitting HAO session. Not only has this study demonstrated that pre-fitting counseling is helpful in expediting hearing aid benefit and satisfaction through the education of our clients, it may suggest that a combination of pre- and post-fitting counseling may be the best clinical procedure to ensure hearing aid acceptance. This supports the findings of Brooks, 1979. Based on the results of this study, a HAO protocol is shown in Figure 4. Further investigation is needed to validate this protocol.

After the audiometric evaluation has provided evidence to support the pursuit of hearing aid intervention for the elderly client, the MHI5 and items 1 and 2 of the GHABP should be administered. Scores obtained from the MHI5 and the first two items of the GHABP will provide insight regarding status of psychological well-being, initial disability and degree of handicap of the individual. These measures can be used to determine the degree of necessity of HAO participation of a given patient to ensure hearing aid use and satisfaction. Some time before the hearing aid fitting appointment, the client should participate in a hearing aid care and use workshop as outlined in Appendix B. Elaboration of all of the materials when conducting a pre- and/or post- fitting HAO is encouraged. At the time of the hearing aid fitting, basic care and use instructions should be reviewed. After the fitting of the hearing aids, the client should attend a workshop on hearing loss. During this meeting the HAMS should be administered and compared to clinic norms. Follow-up visits are encouraged six to eight weeks post-fitting. To document patient satisfaction, the remaining portions of the GHABP should be completed at this time.

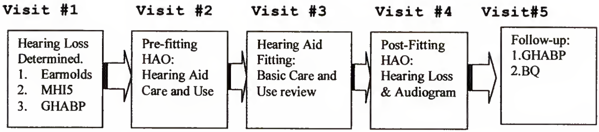

Figure 2. Patient HAO protocol

APPENDIX A
EVALUATION SCALES

Hearing Aid Manipulation Screener

Instruction	Score	
1. remove hearing aid from ear	0	1
2. take out battery	0	1
3. replace battery	0	1
4. place hearing aid in ear	0	1
5. turn hearing aid on	0	1
6. adjust volume	0	1
Total		

TIME:

Rand Mental Health Index (MHI5)

Circle the best answer for each question

1. How much of the time during the last month have you been a very nervous person?”

a} all of the time
b} most of the time
c} a good bit of the time
d} some of the time
e} a little of the time
f} none of the time

2. How much of the time during the last month have you felt calm and peaceful?”

a} all of the time
b} most of the time
c} a good bit of the time
d} some of the time
e} a little of the time
f} none of the time

3. How much of the time during the last month have you felt downhearted and blue?”

a} all of the time
b} most of the time
c} a good bit of the time
d} some of the time
e} a little of the time
f} none of the time

4. How much of the time during the last month have you been a happy person?”

a} all of the time
b} most of the time
c} a good bit of the time
d} some of the time
e} a little of the time
f} none of the time

5. How much of the time during the last month have you felt so down in the dumps that nothing could cheer you up?”

a} all of the time
b} most of the time
c} a good bit of the time
d} some of the time
e} a little of the time
f} none of the time

APPENDIX B
HEARING AID ORIENTATION PROGRAM

Resource Books For The Hearing Impaired

Combs, A. (1986). Hearing Loss Help. Santa Maria, CA: Alpenglow Press.

Erber, N.P. (1993). Communication and Adult Hearing Loss. Melbourne, Australia. Distributed in the USA by A.G. Bell Assoc., Washington, DC: Clavis Pub.

Kaplan, H., Bally, S., & Garretson, C. (1985). Speechreading: A way to Improve Understanding. Washington, DC: Gaullaudet College Press.

Pascoe, D. (1991). Hearing Aids: Who Needs Them? Big Bend Books, St. Louis, MO.

Rezone, S.V. & Hausman, C. (1985). Coping with Hearing Loss and Hearing Aids. San Diego, CA: Singular.

Guidelines for Hearing Aid Use

1 You must be 3 to 10 feet from the speaker.

2. The speaker must be directly in front of you. That means AVOID seats placed in a row when you want to talk to someone. (sofas, benches, cars,…)

3. The area where you are conversing with someone must have very good lighting (no shadows on face). If it does not, ask the person to move where there is good lighting.

4.Find out the topic of the conversation and confirm it with whom you are talking with. Make it a habit to reconfirm with each topic change in the conversation.

5.You will probably not hear every word spoken so fill in the blanks. Use body language, tone, and facial expressions to help fill in the blanks of words you don't hear.

6. Ask the speaker to "PLEASE SPEAK MORE CLEARLY", not "speak louder", as this will make listening with you're hearing aids even more difficult.

7. Be aware of noise where ever you are, and move away from it when you want to talk with someone. Your hearing aids will amplify all sounds including noise.

8. Realize that conversation in groups (i.e. cafeteria, church socials, etc.) is "noisier" than when talking one-on-one. Know that you will have more difficulties hearing with your hearing aids in these situations. Again, move away from the noise (crowd) with whom you want to talk to when conversation is important.

9. Keep your sense of humor, knowing that you will make mistakes.

Factors Reducing Hearing Aid Performance

1 Environmental Noises- Traffic, Crowds, Air vents, Music, TV, Washing dishes…etc.

2. Group Events- Parties, Church, Social events, Malls…etc.

3. Hard surfaces- Walls, Floors, Tables, Ceilings, Windows. All hard surfaces reflect sound, which can interfere with what you are trying to listen to because your hearing aid picks up these reflected sounds as well. Hard surfaces should be treated so that they absorb sounds. Here are some examples:

Hard surfaces	Treatment
Walls	Fabric wall hangings
Floors	Carpeting
Tables	Table clothes
Ceilings	Acoustic ceiling tiles
Windows	Cloth drapes

Caring for Hearing Aids:

- **Need the following tools:**
  1. Wax pick
  2. Hearing aid dehumidifier kit
  3. Extra batteries
  4. Toothbrush
  5. Battery tester (optional)

Care and cleaning of in-the-ear/ in-the-canal hearing aids:

1. Keep the hearing aid dry.
2. Always carry a spare battery
3. Store hearing aid and batteries in a sage place when not in use.
4. Wipe off hearing aid with a tissue whenever you remove it from your ear.
5. Store hearing aid in a dehumidifier each night.
6. Remove battery when hearing aid is not in use
7. Check opening of hearing aid each morning for wax.
8. Brush hearing aid microphone and receiver with toothbrush.

Factors reducing hearing aid performance:

1. Environmental noise- Traffic, Crowds, Air vents, music, TV, Washing dishes…etc.
2. Group events- parties, church, social events, malls…etc.
3. Hard surfaces- walls, surfaces, floors, tables, ceilings, windows. All hard surfaces reflect sound, which can interfere with what you are trying to listen to because your hearing aid picks up these reflected sounds as well. Hard surfaces should be treated so that they absorb sounds.

APPENDIX C
STATISTICS

Covariate simple summary statistics

Var.	Grp	N	Mean	SD	Median	Min	Max
AGE	0	15	72.06	5.66	74.00	60.00	79.00
	1	15	69.53	6.09	71.00	60.00	77.00
	2	14	70.28	5.63	68.00	63.00	80.00
SRT	0	15	32.93	7.70	30.00	24.00	50.00
	1	15	29.33	9.37	27.50	15.00	47.50
	2	14	30.53	5.50	31.25	20.00	37.50
PBMAX	0	15	82.56	8.95	84.00	64.00	94.00
	1	15	78.80	9.31	84.00	64.00	90.00
	2	14	85.71	8.41	88.00	70.00	95.00
GHABP1	0	15	56.91	8.76	55.00	43.75	75.00
	1	15	54.38	13.25	55.00	29.16	85.00
	2	14	45.62	28.02	50.00	0.00	83.33
GHABP2	0	14	40.62	18.24	50.00	0	62.5
	1	15	44.72	24.96	50.00	0	87.5
	2	14	34.58	31.39	31.25	0	80.0
PREM5T	0	15	22.86	3.04	23.00	18.00	28.00
	1	15	22.60	3.73	23.00	15.00	28.00
	2	14	22.07	4.04	23.00	13.00	27.00
PRELAD	0	15	7.40	1.45	8.00	5.00	9.00
	1	15	6.60	1.63	7.00	2.00	9.00
	2	14	6.64	2.02	7.00	2.00	9.00

```
Outcome variable simple summary statistics

Var.    Grp   N      Mean      SD    Median      Min       Max
--------------------------------------------------------------------
HAMSTIME
         0    15    40.26    19.59    34.00     21.00     92.00
         1    15    35.93    29.50    25.00     20.00    132.00
         2    14    37.35    20.43    32.50     25.00    106.00

GHABP3
         0    15    85.50    14.64    87.50     56.25    100.00
         1    15    88.69    12.75    93.75     62.50    100.00
         2    14    83.51    26.34    95.83     25.00    100.00

GHABP4
         0    15    57.55     9.84    60.00     31.25     68.75
         1    15    63.38    14.57    65.00     29.16     83.33
         2    14    62.44    18.72    65.62     25.00    100.00

GHABP5
         0    15    19.00    12.67    15.00      5.00     56.25
         1    15     9.13     7.17    10.00      0.00     25.00
         2    14    10.56    12.25     7.29      0.00     40.00

GHABP6
         0    15    62.44    13.11    65.00     25.00     75.00
         1    15    67.58    10.16    66.66     50.00     93.75
         2    14    65.68    12.48    68.33     37.50     81.25

DGHABP51
         0    15   -37.91    11.48   -37.50    -60.00    -18.75
         1    15   -45.25    12.13   -43.75    -75.00    -25.00
         2    14   -35.05    21.33   -33.12    -66.66      0.00

BQ4
         0    15     2.66     1.04     2.00      1.00      4.00
         1    15     2.73     0.96     2.00      2.00      4.00
         2    14     2.85     1.09     2.50      1.00      4.00

BQ10
         0    15    19.53     3.52    19.00     14.00     25.00
         1    15    20.20     2.73    20.00     16.00     24.00
         2    14    20.14     4.05    20.50     13.00     25.00

BQ11
         0    15     8.20     1.82     8.00      3.00     10.00
         1    15     8.26     1.62     9.00      5.00     10.00
         2    14     8.71     1.32     9.00      7.00     10.00
```

```
POSTM5T
        0     15     23.26       3.95     24.00     15.00     28.00
        1     15     23.73       3.05     24.00     17.00     28.00
        2     14     24.00       3.13     25.00     18.00     28.00


DM5T
        0     15      0.40       2.47      0.00     -4.00      5.00
        1     15      1.13       3.06      0.00     -2.00     10.00
        2     14      1.92       3.19      1.00     -5.00      8.00

POSTLAD
        0     15      7.66       1.44      8.00      5.00      9.00
        1     15      7.40       0.91      7.00      6.00      9.00
        2     14      7.21       1.18      7.00      5.00      9.00
```

```
GHABP5-GHABP1 results:
ANCOVA Model→    Nonparallel Slopes        Parallel Slopes     Unadj
         -------------------------   ----------------   -------
           Covar     Group  Grp*Cov    Covar     Group     Group
         -------------------------   ----------------   -------
Response Covariate P-value  P-value  P-value   P-value  P-value   P-
value
GHABP5-1      Age           0.0412    0.0346    0.0272 *  0.0754   0.2378
0.1972
(post-pre)    SRT           0.9418    0.1337    0.2478    0.4966   0.2313
              PBMax         0.0277    0.5607    0.4840    0.0346   0.5083
              GHABP1        0.0001    0.6197    0.3926    0.0001   0.0398
-Pt#4082 →   GHABP1        0.0001    0.5631    0.6222    0.0001   0.0746
              Pre MHI5T     0.2607    0.0508    0.0285 *  0.1383   0.1685
              Pre Ladder    0.3182    0.1148    0.0565 M  0.1256   0.2135
```

```
GHABP1-adjusted GHABP5-1 group means:
(P SLP)

Group     Mean      SE     Lower95   Upper95
 0      -34.90    2.44    -39.83    -29.96
 1      -43.94    2.42    -48.83    -39.05
 2      -39.70    2.56    -44.87    -34.53

Group Mean
Comparison   Difference Lower95   Upper95
  0 - 1 *       9.05       0.72     17.37
  0 - 2         4.80      -3.94     13.54
  1 - 2        -4.25     -12.87      4.38
```

GHABP1-adjusted GHABP5-1 group means:
(P SLP, Pt#4082 excluded)

Group	Mean	SE	Lower95	Upper95
0	-36.62	2.12	-40.90	-32.34
1	-43.48	2.04	-47.60	-39.36
2	-39.63	2.15	-43.97	-35.29

Group Mean Comparison	Difference	Lower95	Upper95
0 - 1 M	6.86	-0.26	13.98
0 - 2	3.01	-4.42	10.44
1 - 2	-3.85	-11.11	3.42

GHABP5-1 group means at AGE=73:
(NP SLP, p<.05 ABOVE cutpoint)

Group	Mean	SE	Lower95	Upper95
0	-38.16	3.68	-45.61	-30.71
1	-44.05	4.21	-52.57	-35.53
2	-28.75	4.20	-37.25	-20.25

Group Mean Comparison	Difference	Lower95	Upper95
0 - 1	5.89	-7.74	19.53
0 - 2	-9.41	-23.02	4.21
1 - 2 *	-15.30	-29.80	-0.80

GHABP5-1 group means at AGE=77:
(NP SLP, p<.05 ABOVE cutpoint)

Group	Mean	SE	Lower95	Upper95
0	-39.21	4.88	-49.10	-29.32
1	-42.67	5.86	-54.53	-30.81
2	-19.46	5.97	-31.54	-7.37

Group Mean Comparison	Difference	Lower95	Upper95
0 - 1	3.46	-15.14	22.07
0 - 2 *	-19.75	-38.56	-0.94
1 - 2 *	-23.21	-43.62	-2.81

```
GHABP5-1 group means at PreMHI5T=24:
(NP SLP, p<.05 ABOVE cutpoint)

Group     Mean     SE     Lower95   Upper95
 0      -38.96    3.94    -46.94    -30.99
 1      -45.25    3.94    -53.23    -37.26
 2      -29.14    4.25    -37.73    -20.54

Group Mean
Comparison   Difference Lower95   Upper95
 0 - 1          6.28      -7.31     19.88
 0 - 2         -9.82     -23.95      4.30
 1 - 2 *      -16.11     -30.24     -1.98
```

```
GHABP5-1 group means at PreMHI5T=27:
(NP SLP, p<.05 ABOVE cutpoint)

Group     Mean     SE     Lower95   Upper95
 0      -41.73    6.34    -54.56    -28.89
 1      -45.24    5.80    -56.97    -33.50
 2      -19.93    6.13    -32.34     -7.51

Group Mean
Comparison   Difference Lower95   Upper95
 0 - 1          3.51     -17.44     24.46
 0 - 2 *      -21.80     -43.32     -0.28
 1 - 2 *      -25.31     -45.89     -4.73
```

```
GHABP5-1 group means at PreLadder=9:
(NP SLP, MARG signif AT cutpoint)

Group     Mean     SE     Lower95   Upper95
 0      -41.61    5.66    -53.07    -30.15
 1      -43.32    6.79    -57.06    -29.59
 2      -21.80    6.07    -34.09     -9.52

Group Mean
Comparison   Difference Lower95   Upper95
 0 - 1          1.71     -19.84     23.27
 0 - 2 M      -19.81     -40.05      0.43
 1 - 2 M      -21.52     -43.72      0.68
```

GHABP3 results:

	ANCOVA Model→	Nonparallel Slopes			Parallel Slopes		Unadj
		Covar	Group	Grp*Cov	Covar	Group	Group
Response	Covariate	P-value	P-value	P-value	P-value	P-value	P-value
GHABP3	Age	0.7873	0.0781	0.0785	0.8668	0.8985	0.8802
(arcsine)	SRT	0.7675	0.7104	0.7528	0.6924	0.9162	
	PBMax	0.0317	0.7115	0.7310	0.0342	0.8757	
	GHABP1	0.9756	0.5970	0.5454	0.2583	0.8337	
	Pre MHI5T	0.4512	0.1240	0.1064	0.4719	0.8741	
	Pre Ladder	0.4715	0.4926	0.4372	0.6011	0.8409	

BQ4 results:

	ANCOVA Model→	Nonparallel Slopes			Parallel Slopes		Unadj
		Covar	Group	Grp*Cov	Covar	Group	Group
Response	Covariate	P-value	P-value	P-value	P-value	P-Value	
BQ4	Age	0.9382	0.0232	0.0249 *	0.9028	0.8901	
	SRT	0.7515	0.1354	0.1373	0.8646	0.8873	
	PBMax	0.2881	0.3443	0.3513	0.2862	0.7865	
	GHABP1	0.6769	0.7232	0.5575	0.0750	0.6437	
	Pre MHI5T	0.5538	0.0088	0.0094 *	0.8405	0.8879	
	Pre Ladder	0.6173	0.1806	0.1883	0.3517	0.9481	

```
Abq4 group means at AGE=65:                       Back-transformed
(NP SLP, p<.05 BELOW cutpoint)                    BQ4 group means:

Group     Mean     SE     Lower95   Upper95 Group     Mean   Lower95
Upper95
---------------------------------------- ----------------------------
---
  0       0.56    0.20      0.15      0.97   0    1.84      1.07      3.03
  1       0.99    0.16      0.67      1.30   1    3.09      2.17      3.79
  2       1.22    0.18      0.86      1.58   2    3.65      2.72      4.00
Group Mean
Comparison  Difference Lower95   Upper95
  0 - 1        -0.43     -1.05      0.19
  0 - 2 *      -0.66     -1.32     -0.01
  1 - 2        -0.23     -0.81      0.34

Abq4 group means at PreMHI5T=14:                  Back-transformed
(NP SLP, p<.05 BELOW cutpoint)                    BQ4 group means:

Group     Mean     SE     Lower95   Upper95 Group    Mean Lower95   Upper9
---------------------------------------------------------------------
--
  0       0.45    0.38     -0.32      1.22  0       1.57    1.30      3.65
  1       0.44    0.31     -0.19      1.07  1       1.54    1.10      3.30
  2       1.62    0.29      1.04      2.20  2       3.99    3.23      2.97

Group Mean
Comparison  Difference Lower95   Upper95
  0 - 1         0.01     -1.19      1.21
  0 - 2 *      -1.17     -2.33     -0.01
  1 - 2 *      -1.18     -2.20     -0.15

Abq4 group means at PreMHI5T=17:                  Back-transformed
(NP SLP, p<.05 BELOW cutpoint)                    BQ4 group means:

Group     Mean     SE     Lower95   Upper95 Group   Mean Lower95   Upper95
---------------------------------------- -------------------------
  0       0.61    0.27      0.07      1.15   0    1.98      1.01      3.50
  1       0.62    0.22      0.17      1.07   1    2.01      1.09      3.30
  2       1.39    0.20      0.98      1.80   2    3.90      3.06      3.84

Group Mean
Comparison  Difference Lower95   Upper95
  0 - 1        -0.01     -0.86      0.83
  0 - 2        -0.78     -1.60      0.04
  1 - 2 *      -0.77     -1.50     -0.04
```

```
bq4 group means at PreMHI5T=29:            Back-transformed
(NP SLP, p<.05 ABOVE cutpoint)              BQ4 group means:
Group     Mean     SE    Lower95   Upper95 Group Mean  Lower95   Upper95
--------------------------------------- ----------------------------
---
  0       1.24   0.28      0.68      1.80  0    3.68      2.18      3.85
  1       1.34   0.24      0.85      1.83  1    3.84      2.68      3.80
2         0.48   0.25     -0.03      0.99  2    1.64      1.00      3.10

Group Mean
Comparison  Difference Lower95   Upper95
  0 - 1        -0.10     -1.00      0.80
  0 - 2         0.76     -0.16      1.67
  1 - 2 *       0.86      0.00      1.72
```

```
GHABP4 results:

   ANCOVA Model→    Nonparallel Slopes       Parallel Slopes
Unadj
                 -------------------------   ----------------   ----
---
                       Covar    Group  Grp*Cov     Covar     Group
Group
                        -------------------------   ---------------
-   -------
Response      Covariate  P-value  P-value  P-value  P-value  P-value
GHABP4        Age        0.4865   0.2254   0.2501    0.5099   0.6049
              SRT        0.7720   0.3795   0.3510    0.7184   0.5773
              PBMax      0.0398   0.6784   0.7471    0.0388   0.4649
              GHABP1     0.7881   0.2866   0.1941    0.1330   0.3722
              Pre MHI5T  0.2441   0.2507   0.2870    0.1351   0.5566
              Pre Ladder 0.2145   0.5562   0.6429    0.1417   0.7132
```

```
GHABP6 results:

   ANCOVA Model→    Nonparallel Slopes       Parallel Slopes
Unadj -------------------------   ----------------   -------
                       Covar    Group  Grp*Cov     Covar     Group
Group
                        -------------------------   ---------------
-   -------
Response      Covariate   P-value  P-value  P-value   P-value  P-
value   P-value
```

```
GHABP6        Age           0.8739    0.0224    0.0258 *   0.9304
0.5299     0.4998
              SRT           0.3007    0.3066    0.2737     0.0755
0.7077
              PBMax         0.0131    0.8108    0.8630     0.0108
0.4960
              GHABP1        0.1887    0.0543    0.0312 *   0.7492
0.4922
              Pre MHI5T     0.9566    0.0862    0.0977     0.7119
0.5170
              Pre Ladder    0.1551    0.7657    0.7938     0.0985
0.7008
```

```
GHABP6 group means at AGE=66:
(NP SLP, p<.05 BELOW cutpoint)

Group     Mean     SE     Lower95  Upper95
  0      55.78    4.36     46.96    64.60
  1      68.21    3.40     61.32    75.09
  2      70.27    3.85     62.48    78.05

Group Mean
Comparison  Difference Lower95  Upper95
  0 - 1       -12.43    -25.91     1.05
  0 - 2 *     -14.49    -28.66    -0.32
  1 - 2        -2.06    -14.59    10.46
```

```
GHABP6 group means at AGE=64:
(NP SLP, p<.05 BELOW cutpoint)

Group     Mean     SE     Lower95  Upper95
  0      56.29    3.82     48.56    64.02
  1      69.58    3.66     62.17    76.99
  2      67.27    3.67     59.85    74.69

Group Mean
Comparison  Difference Lower95  Upper95
  0 - 1 *     -13.29    -26.19    -0.39
  0 - 2       -10.98    -23.89     1.93
  1 - 2         2.31    -10.32    14.95
```

```
GHABP6 group means at GHABP1=70:
(NP SLP, p<.05 ABOVE cutpoint)

Group     Mean     SE     Lower95  Upper95
  0      51.07    5.39     40.16    61.99
  1      70.83    4.62     61.48    80.17
  2      67.78    4.08     59.52    76.05
```

```
Group Mean
Comparison  Difference Lower95  Upper95
   0 - 1 *    -19.75     -37.06    -2.44
   0 - 2 *    -16.71     -33.20    -0.22
   1 - 2        3.05     -11.99    18.08

BQ10 results:

            ANCOVA Model→   Nonparallel Slopes        Parallel Slopes
Unadj
                          -------------------------   ---------------

-    -------
                            Covar     Group  Grp*Cov    Covar     Group
Group
                          -------------------------   ---------------

-    -------
Response       Covariate  P-value  P-value  P-value   P-value  P-
value   P-value
BQ10           Age         0.7128   0.5446   0.5574    0.7561
0.8792     0.8449
               SRT         0.6899   0.7049   0.6757    0.3904
0.9214
               PBMax       0.1727   0.5301   0.5647    0.1870
0.7997
               GHABP1      0.0921   0.0685   0.0500 *  0.9339
0.8579
               Pre MHI5T   0.6752   0.0435   0.0469 *  0.9428
0.8512
               Pre Ladder  0.9963   0.6942   0.7402    0.8507
0.8740

BQ10 group means at GHABP1=79:
(NP SLP, p<.05 ABOVE cutpoint)

Group      Mean     SE      Lower95  Upper95
  0       14.00    2.40       9.15    18.86
  1       20.52    1.86      16.75    24.28
  2       20.81    1.41      17.95    23.67

Group Mean
Comparison  Difference Lower95  Upper95
   0 - 1       -6.51     -13.92     0.89
   0 - 2 *     -6.80     -13.59    -0.01
   1 - 2       -0.29      -5.98     5.41
```

```
BQ10 group means at PreMHI5T=16:
(NP SLP, p<.05 BELOW cutpoint)

Group      Mean     SE     Lower95   Upper95
----------------------------------------------------------------------
  0       15.88    2.18     11.47     20.28
  1       19.79    1.79     16.17     23.40
  2       22.63    1.64     19.30     25.95

Group Mean
Comparison  Difference Lower95   Upper95
----------------------------------------------------------------------
  0 - 1        -3.91    -10.78      2.96
  0 - 2 *      -6.75    -13.40     -0.10
  1 - 2        -2.84     -8.75      3.08
======================================================================

BQ11 results:

          ANCOVA Model→  Nonparallel Slopes         Parallel Slopes
Unadj
                        -------------------------   ---------------

-   -------
                          Covar    Group  Grp*Cov    Covar    Group
Group
                        -------------------------   ---------------

-   -------
Response      Covariate  P-value  P-value  P-value   P-value  P-
value   P-value
----------------------------------------------------------------------
BQ11          Age         0.5338   0.7218   0.7656    0.4941
0.5809    0.6045
(arcsine)     SRT         0.8469   0.9959   0.9708    0.8924
0.6081
              PBMax       0.4469   0.9724   0.9720    0.4249
0.5062
              GHABP1      0.1549   0.6249   0.4916    0.4050
0.7543
              Pre MHI5T   0.0433   0.0429   0.0615 M  0.0922
0.5009
              Pre Ladder  0.2449   0.4836   0.5413    0.2423
0.5129
======================================================================
BQ11 group means at PreMHI5T=12:              Back-transformed
(NP SLP, MARG signif AT cutpoint)             BQ4 group means:

Group     Mean     SE     Lower95   Upper95 Group     Mean   Lower95
Upper95
--------------------------------------- -----------------------------
---
  0       0.68    0.27       0.14      1.22   0         4.54      1.17
8.92
  1       0.73    0.22       0.30      1.17   1         5.04      1.77
8.64
  2       1.42    0.20       1.01      1.82   2         9.79      7.49
  9.44

Group Mean
Comparison  Difference Lower95   Upper95
______________________________________________________________________
  0 - 1        -0.06       -0.89      0.78
  0 - 2 M      -0.74       -1.55      0.07
  1 - 2 M      -0.68       -1.40      0.03


PostMHI5T-PreMHI5T results:

   ANCOVA Model→    Nonparallel Slopes         Parallel Slopes
Unadj
                 -------------------------   ----------------   ----
---
                          Covar     Group   Grp*Cov    Covar     Group
Group
                                -------------------------   ---------------
-   -------
Response      Covariate   P-value  P-value  P-value   P-value  P-
value   P-value
______________________________________________________________________
Post MHI5T    Age           0.9631   0.2620   0.2892    0.9221
0.3885    0.3802
(post-pre)    SRT           0.0737   0.9656   0.9348    0.0400
0.4749
              PBMax         0.1104   0.0616   0.0853    0.1742
0.2708
              GHABP1        0.7370   0.5179   0.2923    0.2323
0.2574
              Pre MHI5T     0.0051   0.1065   0.1401    0.0016
0.4590
              Pre Ladder    0.0434   0.1842   0.1672    0.0351
0.5574
```

Post-Ladder results:

ANCOVA Model→		Nonparallel Slopes			Parallel Slopes		Unadj
		Covar	Group	Grp*Cov	Covar	Group	Group
Response	Covariate	P-value	P-value	P-value	P-value	P-value	P-value
Ladder	Age	0.0411	0.8596	0.8838	0.0394	0.5262	0.3594
(arcsine)	SRT	0.5866	0.5705	0.6695	0.7863	0.3551	
	PBMax	0.2246	0.7372	0.8186	0.2113	0.3450	
	GHABP1	0.0855	0.5144	0.7179	0.0836	0.1984	
	Pre MHI5T	0.0630	0.6783	0.7784	0.0371	0.4154	
	Pre Ladder	0.1650	0.0755	0.1063	0.0618	0.5776	

REFERENCES

Abrams, H., Hnath-Chisolm T., Guerreiro, S., & Ritterman, S. (1992). The effects of intervention strategy on self-perception of hearing handicap. Ear and Hearing 5,371-377.

Alpiner, J. G. (1987). Evaluation of adult communication function. (J.G. Alpiner & P.A. McCarthy, Eds.) Rehabilitative Audiology: Children and Adults. Baltimore, MD: Williams & Wilkins. 44-114.

Alpiner, J. G., Chevrette, W., Glascoe, G., Metz, M., & Olsen, B. (1974). The Denver scale of communication function. Unpublished manuscript, University of Denver.

American National Standards Institute. (1989). Criteria for permissible ambient noise during audiometric testing (ANSI S3.1-1991). New York: ANSI.

American National Standards Institute. (1991). Specifications for audiometers (ANSI S3.6-1989)New York: ANSI.

American Speech and Hearing Association. (1997). Guidelines for audiologic screening. Rockfield, MD, ASHA.

Andrews, F. M.,& Crandall, R.(1976). The validity of measures of self-reported well-being. Soc. Indicat. Res.,3, 1-19.

Andrews, F. M., Withey SB. (1976). Social Indicators of well-being: Americans' perceptions of life quality. New York: Plenum

Badley, E. M. (1993). An introduction to the concepts and classifications of the international classification of impairments, disabilities, and handicaps. Disability and Rehabilitation,15(4),161-178.

BradBurn, N. (1969). *The structure of psychological well-being*. Chicago: Aldine.

Brooks, D.N. (1978). Hearing aid use and the effects of counseling. *Australian Journal of Audiology,* 1,1-6.

Brooks, D.N. (1979). Counseling and its effects in hearing aid use. *Scandinavian Audiology*. 8, 101-107.

Brooks, D.N. (1985). Factors relating to the under-use of postaural hearing aids. *British Journal of Audiology*,*19*, 211-217.

Brooks, D.N. (1989). The effect of attitude on benefit obtained from hearing aids. *British Journal of Audiology* *23*,3-11.

Brooks, D.N. (1990). Measures for the assessment of hearing aid provision and rehabilitation. *British Journal of Audiology*, *24*,229-233.

Butler, G.S., Hurley, C.A.M., Buchanan, K.L.,& Smith-VanHorne, J.(1996). Prehospital Education: effectiveness with total hip replacement surgery patients. *Patient Education and Counseling,* *29*, 189-197.

Campbell, A. (1976). Subjective measures of well-being. *American Psychologist*, *31*, 117-124.

Carhardt R. (1947). Auditory training. In. H. Davis, (Ed.), *Hearing and deafness*. New York, Rinehart.

Cherry, R, & Giolas,T.G.(1997). Preface. *Seminars In Hearing,18* (2),(75).

Demorest, M. E., & Erdman, S.A. (1987). Development of the communication profile for the hearing impaired. *Journal of Speech and Hearing Disorders*, *52*(2), 129-142.

Dillon,H., James A., & Ginis, J. (1997). Client Oriented scale of improvement (COSI) and its relationship to other means of benefit and satisfaction provided by hearing aids. Journal American Academy Audiology, 8(1), 27-43.

Erdman, S. A., & Demorest, ME. (1998). Adjustment to hearing impairment II. Audiological and demographic correlates. Journal Speech Language Hearing Research,41,123-136.

Ewertsen, H. W. (1974). The use of hearing aids (always, often, rarely, never). Scandinavian Audiology, 3, 173-176.

Ewertsen, H. W., & Neilsen, B. (1973). Social hearing handicap index. Audiology, 12, 180-87.

Feste, C., & Anderson,R.M., (1995). Empowerment: From philosophy to practice. Patient Education and Counseling, 26, 139-144.

Fleiss, J. L. (1986). The Design and analysis of clinical Experiments. (Chapter 7, pp186-219). New York: Wiley.

Folstein, M.F., Folstein, S.E., & McHugh, P.R. (1975). Mini-mental status: A practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research,12(3), 189-198.

Gagne, J.P., Dinon, D., Parsons, J.(1991). An evaluation of CAST: a computer-aided speechreading training program. Journal of Speech and Hearing Research 34:213-221.

Gatehouse, S. (1997). Approaches to the evaluation of the benefits provided by hearing aids and other rehabilitative services. Paper presented at the Annual Summer Institute of the Academy of Rehabilitative Audiology, Magog, Quebec. June 1997.

Giolas, T. G., Owens, E., Lamb, S.H., & Shubert, E.D.(1979). Hearing performance Inventory. Journal of Speech and Hearing Disorders, 29, 215-230.

Graney, M., & Graney, E. (1974). Communications activity substitutions in aging. Journal of Communications, 24, 88-96.

Haggard, M. P., Foster, J. R., & Iredale, F. E. (1981). Use and benefit of postaural aid in sensory hearing loss. Scandinavian Audiology. 10(1). 45-52.

Hathaway D. (1986). Effect of preoperative instruction on postoperative outcomes:a meta-analysis. Nursing Research, 35, 269-275.

Henrichsen, J., Noring, E., Lindemann, L. Christensen, B., Pedersen, F., & Parving, A. (1988). In-the-ear hearing aids. The use and benefit in the elderly hearing-impaired. Scandinavian Audiology 17(4), 209-12.

High, W., Fairbanks, G., & Glorig, A. (1964). Scale for self-assessment of hearing handicap. Journal of Speech and Hearing Disorders, 29, 215-230.

Holmes, A. E. & Kemker, B. E. (1995). Perceived hearing aid satisfaction. Unpublished Document. University of Florida.

Holmes, A. E.(1995). Hearing aids for the older adult. In: P. Kricos & S. Lesner (eds.), Hearing Care for the older adult, pp. 59-75. PA: Andover.

Hull, R. (1992). What is aural rehabilitation? In R. Hull (Ed.), Aural rehabilitation, 2nd ed. (pp. 3-14). San Diego: Singular.

Humes, L. E., Halling, D., & Coughlin, M. (1996). Reliability and stability of various hearing-aid outcome measures in a group of elderly hearing aid wearers. Journal of Speech and Hearing Research, 39, 923-935.

Hutton, C. L. (1991). Considerations in design and use of scales in rehabilitative audiology. Journal of the American Academy of Audiology,2, 115-122.

Jerger, J., Chmiel, R., Florin, E., Pirozzolo, F., & Wilson, N. (1996). Comparison of conventional amplification and an assistive listening device in elderly persons. Ear & Hearing, 17, (6), 490-504.

Kaplan, H., Bally, S. & Brandt, F. (1991). Communication scale for deaf adults. Journal of the American Academy of Audiology, 2(3), 164-182.

Kaplan, H., Bally, S., Brandt, F., Busacco, D.,& Pray, J. (1997).Communication scale for older adults (CSOA). Journal of the American Academy Audiology, 8: 203-217.

Kapteyn, T.S. (1977).Satisfaction with fitted hearing aids I. An analysis of technical information. Scandinavian Audiology,6: 147-156.

Korper, S. P. (1989). Epidemiologic and demographic characteristics of the aging population. In J.G. Goldstein, H.K. Kushimu, & C.F. Koopman (Eds.), Geriatric otorhinolaryngology (pp.19-29). Toronto:Decker.

Kricos, P. B., & Holmes, A. E. (1996). Efficacy of Audiologic rehabilitation for older adults. Journal of the American Academy of Audiology, 7, 219-229.

Kricos, P., Holmes, A. & Doyle, D. (1992). Efficacy of a communication training program for hearing-impaired elderly adults. Journal of the Academy of Rehabilitative Audiologists 25;69-80.

Kricos, P.B., Lesner, S.A., & Sandridge, S.A. (1991).Expectations of older adults regarding the use of hearing aids. Journal of the American Academy of Audiology, 2(3), 129-133.

Lesner, S., Sandridge, S.,& Kricos, P. (1987). Training influences on visual consonant and sentence recognition. Ear and Hearing *8*:283-287.

Malinoff, R., & Weinstein, B. (1989). Measurement of hearing aid benefit in the elderly. Ear and Hearing, 10, 354-356.

McCarthy, P. A., & Alpiner, J. G. (1980). The McCarthy-Alpiner Scale of Hearing Handicap. Unpublished Manuscript.

McCarthy, P. A., Montgomery, A., & Mueller, H. G. (1990). Decision making in rehabilitative audiology. Journal of American Academy of Audiology, 1(1), 23-30.

McDowell, I., & Newell, C. (1996). Measuring health: a guide to rating scales and questionnaires. 2nd ed. New York: Oxford University Press.

Mulrow, C., Tuley, M., Aguilar C. (1992). Sustained benefits of hearing aids. Journal of Speech and Hearing Research, 35, 1402-1405.

Mumford E., Schlesinger, H. J., & Glass, G. V.(1982). The effects of psychological intervention on recovery from surgery and heart attacks: An analysis of the literature. American Journal Public Health, 72: 141-151.

Nagi, S. Z. (1991). Disability concepts revisited: implications for prevention. In: Disability in America: Toward a national agenda for prevention A.M. Pope, & A.R. Tarlov (Eds.), (309-327). Division of health promotion and prevention, Institute of medicine. Washington, DC: National academy Press, 1995.

Neugarten, B.L., Havighurst, R.J., Tobin, S.S.,(1961). The measurement of life satisfaction. Journal of Gerontology,16, 134-143.

Newman, C., & Weinstein, B.(1986). Judgements of perceived hearing handicap by hearing-impaired elderly men and their spouses. Journal of the Academy of Rehabilitative Audiology,19, 109-115.

Newman, C. & Weinstein, B. (1988). The hearing handicap for the elderly as a measure of hearing aid benefit. Ear and Hearing,9, 81-86.

Noble, W. G., & Atherly, G. R. (1970). The hearing measure scale, a questionnaire for the assessment of auditory disability. Journal of Auditory Research,10, 229-250.

Oja, G. L., & Schow, R. L. (1984). Hearing aid evaluation based on measures of benefit, use, and satisfaction. Ear & Hearing,5, (2),77-86.

Parving, A. & Phillip, B. (1991). Use and benefit of hearing aids in the tenth decade and beyond. Audiology,30, (2), 61-69.

Prochaska, J. A. (1991). Assessing how people change. Cancer, 67, 805-7.

Rappaport, J.(1987). Terms of empowerment/examples of prevention: toward a theory for community psychology. Am. Journal of Counseling Psychology,15, 121-149.

Rubinstein, A., & Boothroyd, A. (1987). Effects of two approaches to auditory training on speech recognition by hearing impaired adults. Journal of Speech and Hearing Research,30,153-161.

Salamon, M., & Conte, V. (1986). Life Satisfaction in the Elderly Scale (LSES). Odessa, FL: Psychological Assessment Resources.

Schow, R. L., Balsara, N. R., Smedley, T. C., & Whitcomb, C. J. (1993). Aural rehabilitation by ASHA audiologists, 1980-1990. American Journal of Audiology,2,(3): 28-37.

Selvin S. (1991). Statistical Analysis of Epidemiologic Data. (Chapter 8, pp 214-240). New York: Oxford University Press.

Smaldino, S.E., & Smaldino, J.J. (1988). The influence of aural rehabilitation and cognitive style disclosure on the perception of hearing handicap. Journal of the Academy of Rehabilitative Audiologists,21, 54-67.

Snedecor, G.W., & Cochran, W.G. (1980).Statistical Methods, (7th ed.) (Chapter 10, pp175-193, for correlations; Chapter 15, pp 274-297 for transformations). , Ames IA: Iowa State University Press.

Speaks, C., Jerger, J. & Trammell, J. (1970). Measurement of hearing handicap. Journal of Speech and Hearing Research, 13: 768-776.

Stewart, A.L., Ware, J.E. Jr., & Sherbourne C.D.(1992). Psychological distress/well-being and cognitive functioning measures. In: A. Stewart & J. Ware (Eds.), Measuring functioning and well-being: The Medical Outcomes Study Approach. Durham, NC: Duke University Press.

Surr, R., Schuchman, G.,& Montgomery, A.(1978). Factors influencing use of hearing aids. Archives of Otolaryngology, 104, 732-736.

Ventry, I., & Weinstein, B. E. (1982). The hearing handicap inventory for the elderly, a new tool. Ear & Hearing,3, 128-134.

Ventry I., & Weinstein B. E. (1983). Identification of elderly people with hearing problems. ASHA,25, 37-42.

Verbrugge, L. M., & Jette, A. M. (1994). The disablement process. Social Science Medicine,38,(1), 1-14.

Walden, B., Erdman, S., Montgomery, A., Schwartz, D., Prosek, R.(1981). Some effects of training on speech recognition by hearing-impaired adults. Journal of Speech and Hearing Research,24, 207-216.

Wallerstein, N., & Bernstein, E. (1988). Empowerment education: Freire's ideas adapted to health education. Health Education Quarterly. 15, 379-394.

Ward, P. R. (1981). Effectiveness of aftercare for older people prescribed a hearing aid for the first time. Scandinavian Audiology,10, 99-106.

Ward P., Gowers, J. (1980). Fitting hearing aids: The effects of methods of instruction. British Journal of Audiology,14, 15-18.

Webber G. C. Patient education: a review of the literature. Med Care 1990,28, 1089-1103.

Weisberg, Sanford (1980). Applied linear regression. (Chapter 5, Residuals and Influence, pp 106-113). New York: Wiley.

BIOGRAPHICAL SKETCH

Brett Edward Kemker was born December 7, 1963, in Knoxville, Tennessee. He graduated from the University of South Florida with a Bachelor of Arts degree in Communication Sciences in 1992. He began his graduate studies at the University of Florida in 1993 and received his Master of Arts degree from the department of communication sciences and disorders in 1995. During this time Mr. Kemker married his wife, Denise, in December of 1994. In the spring of 1996 he returned the University of Florida to pursue doctoral studies in audiology. He is currently an Assistant Professor and Chief Audiologist at the Florida State University, where upon completion of the requirements for the Doctor of Philosophy degree, he intends to continue his career in research and education.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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Alice E. Holmes, Chairman
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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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